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Clearwater

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THE BUTTE WATER COMPANY
"YESTERDAY—TODAY—TOMORROW"

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If you have any ideas or information that you would like to pass along to other people involved in the water and wastewater field, please don't hesitate to contact the office of the Water Quality Bureau. This publication welcomes articles of interest and random pieces of information regarding anything to do with water.

An article may consist of your own thoughts and ideas about something you may have experienced. Perhaps such information could help someone else in their day-to-day work. It could also be a technical article that is developed from research information and library resource material. If it has to do with water and you think it may be of interest, give us a call at the WQB: 444-2406.

If you do not wish to continue receiving this publication please send us your name and address so that we can remove your name from our mailing list.

Rick Rosa
Water Quality Bureau
Department of Health & Environmental Sciences
Cogswell Building
Helena, MT 59620

The Big Sky Clearwater is for water and wastewater operators across Montana. It is published two times a year by the Water Quality Bureau of the State Department of Health and Environmental Sciences in cooperation with the Montana Section of the American Water Works Association and the Montana Water Pollution Control Association.

Publication dates: February 1 and August 1. Last date to receive contributions is 30 days before publication.

The following article illustrates a perfect example of the plight of many Montana communities at the present time. Many cities and towns are faced with the problem of having to deal with outdated water distribution systems and sources of supply. In many communities, nothing has been done for years in terms of updating portions of the water system. The reason for this in a lot of cases is that it is not always very politically popular to raise water rates in order to regularly maintain a water system. In other words, if it isn't broke, don't fix it. This logic is fine until all or most of the water system components are no longer useful and everything must be replaced or renovated at the same time. This usually leaves the water user with a very high price tag for repairs.

THE BUTTE WATER COMPANY, "YESTERDAY--TODAY--TOMORROW"

By: Mike Patterson
Butte Water Company

The Butte Water Company is very unique in regards to how it delivers water, who has owned the company,and politics which have affected it. The first step in explaining where we are today, and where we may go in the future, is to look into our past.

YESTERDAY

Butte, Montana is nearly encircled by the Continental Divide. Silver Bow Creek, which drains this summit valley, escapes through a canyon in the western rim to join the Clark Fork of the Columbia River.

The first prospectors in 1884 found adequate water in the creek and its tributaries; shallow wells provided for the residents of the camp through the 1870's. However, as mines went deeper, they drained the aquifer supplying the wells -- and the water produced by the mines was a dilute sulfuric acid unfit for any domestic, industrial, or agricultural use.

The Silver Bow Water Company, organized in 1881, brought the first supply to town through a seven mile long wooden flume from a location north of Butte known as Bull Run Gulch. To this they added an undependable supply from Yankee Doodle Creek, and for a brief period, pumped the polluted waters of Silver Bow Creek from a point a mile-and-a-quarter below the city. They secured water rights in a gulch west of town and brought a supply from Basin Creek (a tributary of Silver Bow Creek located south of town) through eleven miles of pipes and flumes. Meanwhile, the city tripled in population within the decade of the 1880's and the water demands of the mines, mills, and smelters increased at an even greater rate.

The Anaconda Company, owner of nearly all the mines and mills of Butte, established their smelter at Anaconda which is about 25 miles to the west. The company developed a water supply system for the smelter and built the Butte, Anaconda and Pacific Railroad to transport ore to the water needed to process it. In February, 1890, a third water company was organized after the city granted a franchise to the Silver Bow Hydraulic Mining Company. They held water rights on Divide and Jerry Creeks on the eastern slopes of the divide and they wanted to develop a supply from there.

The resulting fracas between the three water companies and their supporters, including three newspapers never noted for their moderation, was long and bitter. To shorten a very involved tale, let it merely be mentioned that the Butte City Water Company was organized and it purchased the Silver Bow Water Company and the Silver Bow Hydraulic Mining Company. This company secured a franchise in May, 1891, to bring a supply of water to Butte from Divide and Jerry Creeks by means of a pipeline which would cross the main range of the Rocky Mountains in Deer Lodge Pass at an elevation of 5,800 feet. In addition, they built Basin Creek Dam in 1892 and laid a wood stave pipeline to the South Side Distributing Reservoir, both of which are still in service today.

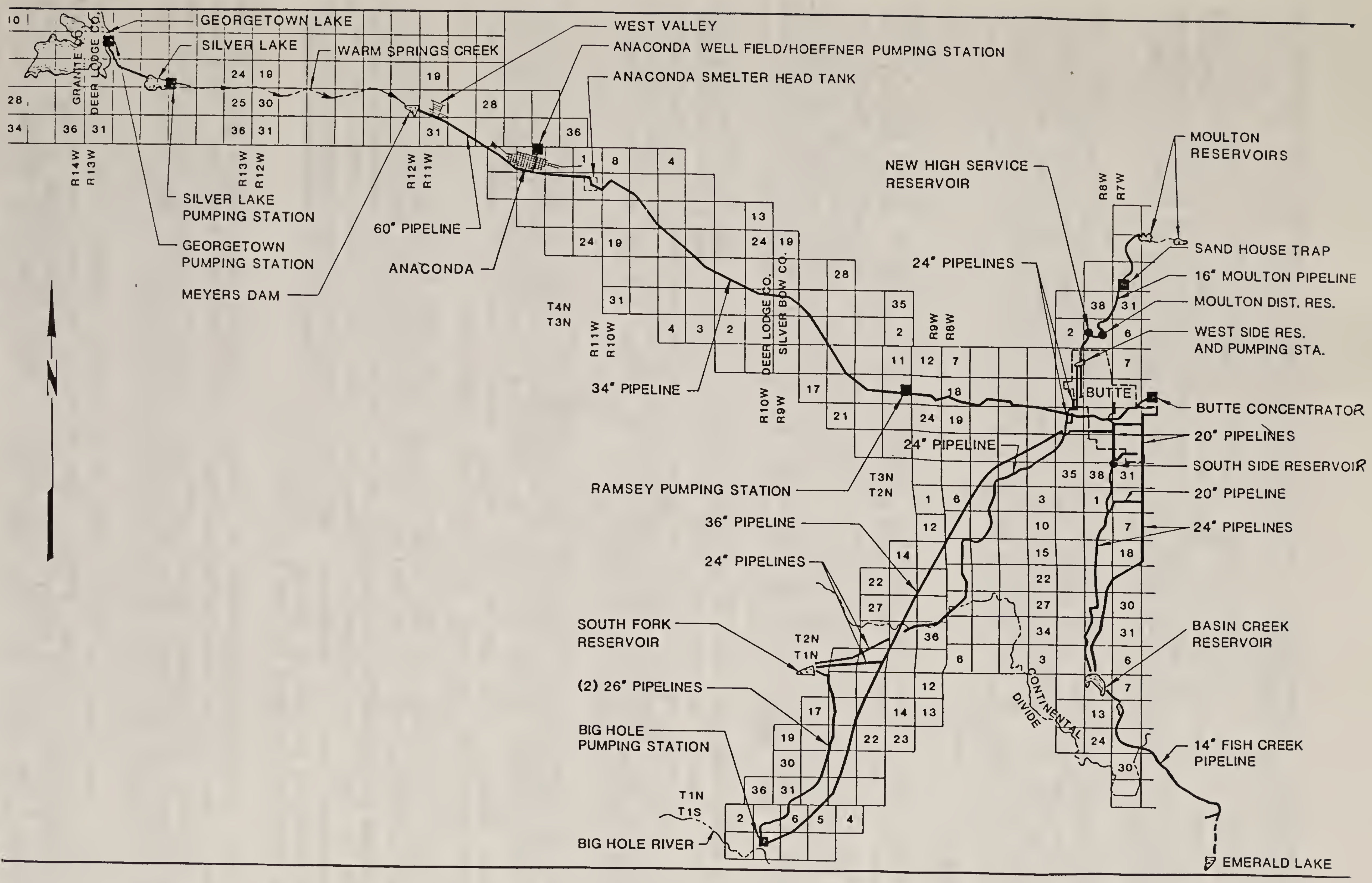
The Butte City Water Company was reorganized as the Butte Water Company in 1898. In 1899 it installed a pumping plant on the Big Hole River capable of lifting 14 million gallons per day, at a head of 840 feet, over the Continental Divide to its reservoir on Basin Creek.

TODAY

The same company still serves Butte. Keeping pace with a population which tripled again in the 1890's, the Company established three independent sources of water. (Please refer to the enclosed diagram.) Yankee Doodle Creek, developed by means of two dams, lies eight miles north of the city. It supplies water to the Moulton Reservoirs. The Basin Creek Reservoir is located on the south side of Butte and it receives flow from both Basin Creek and Fish Creek. The Fish Creek line was built in about 1911 and it is a 16-inch wood stave pipeline that allows water to flow into the reservoir from the opposite side of the Continental Divide. Basin Creek produces 4 million gallons per day and Fish Creek supplies 1.0 million gallons per day. The Big Hole River Supply, from across the Divide, pumps water nine miles to the South Fork Reservoir on Divide Creek. The South Fork of Divide Creek also augments the reservoir. Two wood pipelines carry water from the Big Hole to South Fork Reservoir; the first line was constructed in 1901 and the second, in 1920. Two wooden lines, now combined into one, gravity flow water from the South Fork Reservoir 23 miles to town to the West Side Reservoir and the South Butte System.

In 1979 a new 36" steel line from the Big Hole River to Butte was completed and was intended to replace the two wooden lines. However, it does not have enough head to get water to the West Side Reservoir and during spring runoff on the Big Hole River it cannot be used because of high turbidity and color in the supply. Therefore, during the spring and early summer, the two wooden pipelines are used to pump water with the addition of liquid alum, nine miles to the South Fork Reservoir. At the Reservoir we have a settling pond with concrete baffles and homemade roughing filters. Substantial turbidity and color removal is accomplished using a sweep floc.

The fifteen square mile area served by the Company, which includes Butte and the surrounding suburbs, ranges in elevation from 5,410 to 6,368 feet. To maintain appropriate pressures in the distribution system, seven different pressure zones have been established. More than 20 pressure-reducing valves are used, ranging in size from 6-inch to 12-inch. Reservoirs have been constructed and piping interconnections installed between the three independent sources in such a way


GEORGETOWN LAKE
SILVER LAKE
WARM SPRINGS CREEK
WEST VALLEY
ANACONDA WELL FIELD/HOEFFNER PUMPING STATION
ANACONDA SMELTER HEAD TANK
GRANITE CO.
DEER LODGE CO.
R14W
R13W
R12W
R11W
R10W
R9W
R8W
R7W
T4N
T3N
T2N
T1N
T1S
SILVER LAKE PUMPING STATION
GEORGETOWN PUMPING STATION
MEYERS DAM
60" PIPELINE
ANACONDA
34" PIPELINE
SILVER BOW CO.
NEW HIGH SERVICE RESERVOIR
24" PIPELINES
MOULTON RESERVOIRS
SAND HOUSE TRAP
16" MOULTON PIPELINE
MOULTON DIST. RES.
WEST SIDE RES. AND PUMPING STA.
BUTTE
BUTTE CONCENTRATOR
20" PIPELINES
SOUTH SIDE RESERVOIR
20" PIPELINE
24" PIPELINES
24" PIPELINE
RAMSEY PUMPING STATION
36" PIPELINE
24" PIPELINES
SOUTH FORK RESERVOIR
(2) 26" PIPELINES
BIG HOLE PUMPING STATION
BIG HOLE RIVER
CONTINENTAL DIVIDE
BASIN CREEK RESERVOIR
14" FISH CREEK PIPELINE
EMERALD LAKE
N

that pumping is minimized and that continuity of service and ability to react to emergencies is maximized.

All of our sources are treated with chlorine. Ammonia is also added at the Big Hole pumping station and West Side Reservoir in order to form a combined chlorine residual. We are fortunate in that water leaving the Big Hole takes up to three days before it reaches Butte, thus allowing a lot of time for chlorine inactivation of bacteria, viruses and cysts such as Giardia.

In the summer months we add copper sulfate to the Basin Creek, South Fork, and West Side Reservoirs. This helps eliminate algae blooms (species -- Anabaena). We use a boat to crisscross the ponds and add ten pounds of copper sulfate per million gallons. We also monitor copper levels and maintain a .3 to .5 MG/L level, which keeps the algae from becoming a problem.

TOMORROW

In about 1979, when the Anaconda Company began shutting down its Montana operations, Gary Mannix, then Butte Water Company President, began looking into the use of the Silver Lake pipeline. Water from Silver Lake west of Anaconda is used to supply the Butte Concentrator and in the past, it supplied the water for the Anaconda smelter. The existing transmission main can deliver 18 million gallons of water per day to the community of Butte and the water has a turbidity and color level about 500 times lower than the Big Hole water supply.

The Anaconda Smelter used 40 million gallons of Silver Lake water per day and when it closed, the need for this supply in Anaconda was almost eliminated. Only a very small percentage of the water is used to supplement the water supply for the city of Anaconda during high water usage periods. The current owner of the Concentrator in Butte requires 7 million gallons per day and that leaves 11 million gallons available for other use.

The Butte Water Company is of the opinion that the Silver Lake water supply is of extremely good quality and may be exempt from future filtration requirements. The distribution system is also in excellent condition as oppossed to our present system. The use of this supply would allow us to make other needed improvements first and keep the water user rates lower.

In 1985, the stock of the Water Company was sold to Dennis Washington, a Missoula businessman. Jim Chelini, a Butte financial and business consultant was hired as President of the Butte Water Company. A public awareness campaign began to let the citizens of Butte know that their water system was very deteriorated and in desperate need of upgrading. Plans continued to be formulated to acquire a portion of, or all, of the Silver Lake water supply, thus reducing the need for the Big Hole supply.

In 1986, Don Howard Engineering of Covina, California was hired to appraise the value of the Silver Lake System and evaluate our existing supplies. This task was completed and recommendations were made to actively pursue acquiring Silver Lake water. At the same time, a citizens study committee was formed to look into the recent publicity of a deteriorated water system.

In 1987, the Committee hired James M. Montgomery Engineers and Sorenson and Company to do a Master Plan. The Master Plan has been completed and recommendations include using Silver Lake water and Basin Creek as the primary supplies. The study also determined that we are experiencing leakage rates of

20% to 68% on the wooden transmission mains. However, this really didn't surprise us since we repair over 500 leaks in our distribution system each year and there are crews working seven days per week to keep the wood transmission mains together.

Presently, we are at a stalemate with the Montana Public Service Commission as to which sources of water to use and what method of financing is acceptable. Our company is 70% depreciated, compared to most others who are about 30% depreciated. Because of our situation, we are not able to find any lenders of money. Even if we did, the $33 million dollars of improvements would generate extremely high interest amounts. Dennis Washington seems to be skeptical of investing large amounts of money and then finding himself in the same situation as Montana Power Company was in with Colstrip #3 and #4. We have had several other prospective buyers in to look; however, because of our small rate base and large capital requirements, they have quickly gone away. It appears that either Washington or the local city government are the only two who could own the Water Company. Bankruptcy is a possibility, as we have lost millions of dollars over the last ten years; however, I think some other solution will be found.

In recent years politics has played a major role in determining our future. As the saying goes, "history repeats itself". In our case, it is ironic that the ore was transported to the water in Anaconda; now we want to transport the water from Anaconda to the people. It is also interesting to note that the Butte Water Company filed bankruptcy at the turn of the century and now it is being considered once again. In addition, politicians campaigned for what sources we should use in the early 1900's, the same as today.

It is my observation that, while the Anaconda Company owned Butte Water, water rates were kept artificially low because the primary concern was to supply adequate water to the mines. In later years under the Atlantic Richfield merger with Anaconda, more emphasis was put on raising rates. However, only minor capital improvements have been made in the last 68 years, other than a steel line at Basin Creek to augment the existing two wood lines, and the Big Hole 36-inch steel line. The Butte Water Company has experienced the ups and downs of the copper mining industry.

One thing I know for sure, is that as long as there are people in Butte, there will be a water company serving them. The question is, who will make the desperately needed improvements and how soon? Will people go without water before the decisions are made?

THE BILLINGS PUMPS ARE ROARING

By: Jan Cranor
Billings Water Treatment Plant

The water pumped during the month of June in Billings set new records. The old maximum day pumpage record was surpassed numerous times with the new maximum day pumpage at 42,200,000 gallons set on June 6. The total water pumped in June was 1,070,000,000 gallons.

How much water is a billion gallons? If a billion gallons of water was stored on a square city block, the water would be about 400 feet deep. Or a billion gallons is about 14,000 gallons for every man, woman and child served by the city of Billings water system.

WATER TREATMENT AT THE TAP
DO I NEED IT?

By: John Hawthorne
Chemistry Laboratory, Department of Health & Environmental Sciences

Changing EPA regulations and the accompanying media attention are making people think twice about their drinking water. More and more people are considering treating their water at the point of use -- their home. Numerous treatment options are available to the homeowner, from single faucet units to systems that treat entire buildings.

The most common home water treatment unit is the softener. Hard water contains excess calcium and magnesium that precipitates soap. This causes soap scum and reduces laundering efficiency and contributes to scale deposition in pipes and water heaters. Water softeners use a resin that removes calcium and magnesium from the water and replaces them with sodium. The softeners periodically recharge themselves with a wash of sodium chloride (rock salt).

Softeners are usually recommended for water with a hardness of 10 grains per gallon or higher, but personal preferences vary considerably. Hard water is generally considered to be better tasting than soft water. However, since it increases the sodium content, people on salt-restricted diets should consult with a physician before drinking softened water.

Another common complaint about drinking water is that it is cloudy, turbid or sometimes downright muddy. Water filters that will remove this suspended sediment are available at most hardware stores and water conditioning shops. Several types are available in various pore sizes. The lower the pore size, the smaller the particle that will be caught by the filter but the slower the flow through the filter. The filter element must be changed when clogged and normal flow through the filter is reduced.

Taste and odor are popular concerns among water users. Most taste and odor problems are caused by dissolved gasses or organic compounds in the water. Activated carbon is the material of choice to remove these contaminants. Activated carbon also removes toxic organic compounds and disinfection by products such as chloroform.

Activated carbon works by adsorption, that is, holding contaminants on the surface of the carbon particles. Generally, the more carbon in the filter element and the longer the contact time with the water, the more efficient the removal of the contaminants. However, because the contaminants are on the surface of the carbon, they help provide a nutrient-rich area for bacteria to grow. Indeed, high bacteria populations are associated with carbon filters, especially if they have been left stagnant for a period of time. One preliminary study indicated, however, that the bacteria associated with carbon filters were non-pathogenic. It should also be mentioned that activated carbon can sometimes release contaminants toward the end of the filters life. Manufacturer's recommendations must be followed to prevent the activated carbon from actually causing problems rather than rectifying them.

Another popular treatment method is reverse osmosis (RO). In a RO system, water under pressure passes through a semi-permeable membrane while dissolved and particulate contaminants are left behind to be flushed down the drain. RO systems remove about ninety percent of all dissolved matter when working properly. Often, RO units are used in combination with activated carbon and sediment filters. Different types of membranes are available for either chlorinated or non-chlorinated water, and have about a one year life span. A storage tank is usually required because the production rate is low, sometimes only three gallons per day.

Distillation is a classic method of treating water. Unfortunately, it has several disadvantages for home use. Distillers are expensive to purchase and operate, require constant maintenance and are slow to produce pure water. While generally efficient at removing dissolved minerals and sediment, distillers can actually concentrate some organic compounds and gasses in the water they produce.

Anyone considering purchase of a home treatment system should identify the problems they think need to be remedied. They then should discuss the problems with the water supplier. Water suppliers are required to test for contaminants and can explain the results of those tests. If a home treatment system is still desired, the next step is to determine the type of system needed and what capacity would be required. The potential buyer should be aware of questionable claims by some manufacturers and scare tactics used by some sales people. Not all sales people are familiar with what contaminants may be in the water, the best method to remove them, or even how their own product works.

The National Sanitation Foundation (NSF) is an independent, non-profit organization that tests home treatment systems to make sure they perform up to NSF standards and manufacturer's claims. If the units meet NSF requirements they are listed by NSF in its **Annual Listing for Special Categories of Equipment**. Requests for the list or for information about specific products can be made to NSF, 3475 Plymouth Road, P. O. Box 1468, Ann Arbor, Michigan 48106.

The Water Quality Association is an organization made up of manufacturers and distributors of home treatment systems that sets standards for its members to adhere to. Several water treatment dealers in Montana are affiliated with this organization through the Montana Water Quality Association.

The treatment methods discussed here are only concerned with sediment and chemical removal. These methods may not be applicable for bacteria removal. Home treatment units can be of value, but only if properly selected and maintained.

HOME WATER TREATMENT FOR PATHOGEN REMOVAL

By: Donna Howell
Water Quality Bureau

Although there are a lot of home water treatment units currently available for chemical removal, not all of them are meant for controlling harmful microorganisms. In most cases, chemicals adsorb to the filter resin or activated charcoal while organisms require an actual physical barrier for their removal [adsorption means the compounds are held onto the filter particle surface by chemical bonds]. Because adsorption occurs rather easily and quickly, it is an effective chemical removal method and allows relatively rapid flow rates through the treatment unit. The small size of microorganisms and their inability to adsorb to the filter makes their control a more complicated issue.

Home disinfection systems such as UV light or chlorine are useful for controlling bacteria and viruses in groundwater, but more resistant surface-water organisms such as Giardia should be removed by physical straining. Alternatively, Giardia, bacteria and viruses can all be removed by straining, but this requires a filter with such small pores that water flow is often too slow and the filter may easily plug.

To put filter pore-sizes in perspective, microorganisms which cause disease range from less than 0.5 microns for viruses to about 1 micron for bacteria and 10-12 microns for Giardia (a micron is one millionth of a meter). If filtration alone is to be used, pore-sizes of about 1-3 microns are needed for removal of the pliable Giardia cyst, with 0.45 microns for bacteria removal and about 0.2 microns for virus removal. When treating surface water, a roughing filter of 10-20 microns may also be needed to remove silt and larger particles which rapidly plug the smaller pore-sized filters. To provide protection from all of these pathogens and still obtain acceptable water production, filtration through pores of about 1-3 microns to remove parasites is recommended followed by disinfection for bacteria and virus kill.

When home water treatment units advertise their ability to remove "harmful microorganisms" the claims should be investigated to determine what organisms are removed and whether specific testing has been done to verify that the removal is reliable and complete. Many manufacturers have had their units tested by independent laboratories for removal of Giardia cysts and bacteria, and you can bet they will have this information available in their promotional material. Don't accept vague claims as reliable, competition in the home treatment unit market has provided a large selection of reputable products with verifiable treatment abilities. Home water treatment units are also tested by the National Sanitation Foundation for Giardia cyst removal. NSF maintains a list of units which they found to be acceptable and is available to consumers (see the article in this issue titled, "Water Treatment At The Tap - Do I Need It", for the NSF address). Acceptable units will also display the NSF mark on their product or packaging. The Water Quality Bureau also maintains a partial list of filters known to remove Giardia cysts.

DROUGHT WATCH

By: Rich Brasch
Department of Natural Resources and Conservation

Many areas of Montana are in the midst of another dry summer. Mountain snowpack peaked at 80-85% of normal this winter and peak runoff occurred anywhere from 1-3 weeks early. The result was a relatively low peak runoff with stream flow decreasing rapidly to much lower than normal levels for this time of year. The July 10th flow of 4,110 cfs for the Yellowstone River at Billings is the lowest ever recorded for that date over a period of record which extends from 1936 to the present. Flows in the Missouri (near Toston) and Musselshell rivers are near record lows for this time of year while those in the Flathead, Clark Fork, and Upper Missouri tributaries are slightly better but still well below normal.

Precipitation in the northwest part of the state has been normal to above normal since April 1, and southcentral and southwestern Montana are generally near normal. However, the southeastern and northeastern parts of the state continue to suffer from large growing season precipitation deficits. As of July 9, Glendive had received 18%, Miles City 19%, and Broadus 30% of normal precipitation since April 1 of this year. The resulting poor top soil and sub-soil moisture has caused widespread dryland crop damage in these areas of the state.

Little good monitoring information is available which identifies the impact of the drought on groundwater resources but groundwater is generally less susceptible to short-term dry periods. However, prolonged drought results in poor groundwater recharge conditions. This has occurred over the last several years in many parts of the state and an increasing number of "well failures" have been documented this year in northwestern Montana near Columbia Falls and in the Gallatin River Valley.

UNIQUE TRAINING EXPERIENCE
55th Annual Operators School

DATES:	September 26 to September 29, 1988
PLACE:	Strand Union Building, Montana State University
REGISTRATION:	8:00 TO 9:30 a.m. on September 26 **(NO PREREGISTRATION)**
COST:	$50 (payment to MSU)
CEC's:	up to 2.5

We are pleased to announce the Fifty-fifth Annual Operators School to be held September 26 through September 29, 1988 at Montana State University in Bozeman, Montana. This year's school will include topics presented by nationally-known experts complimented by sessions giving Montana's own experiences. In addition to the general sessions, sessions for operator study (SOS) have been scheduled. The SOS will offer individual instruction in solving math and hydraulic problems encountered in the day-to-day operation of water and wastewater systems. All of the sessions will be of great help to those planning to take the Operator's Exam on Friday, September 30 or at other scheduled times throughout the year.

The operator certification exam is administered separately from the Operator's School. You do not have to take the exam if you attend the Operator's School, nor do you have to attend the Operator's School in order to take the exam. However, you should find the exam much easier after four days of participation at the school. If you wish to take the exam, you must contact Rosemary Fossum, DHES, Water Quality Bureau, Cogswell Building, Helena, MT, 444-2691.

As a reminder, attendance at the Operator's School will satisfy the continuing education credits required by June 30, 1990 for all operators.

This year's registration fee is $50. Checks and purchase orders should be made out to Montana State University and be brought to the school; there is no preregistration. This year's school will be held in the Strand Union Building (SUB). Each person will have to make his/her own arrangements for lodging and meals.

We are expecting an informative, useful and exciting school this year. Hope to see you there!

For further information contact:

Denise Ingman or
Dick Pedersen
Water Quality Bureau
Department of Health and
Environmental Sciences
Cogswell Building
Helena, MT 59620
444-2406

Howard Peavy
Department of Civil and
Agricultural Engineering
412 Cobleigh Hall
Montana State University
Bozeman, MT 59717
994-6690

EXAMINATION NOTICE

ON FRIDAY------------------SEPTEMBER 30, 1988-----------8:30 A.M. TO 12:30 P.M.

IN BALLROOM B, STRAND STUDENT UNION BUILDING, MSU CAMPUS, BOZEMAN, MONTANA

examinations for certification as a Water Distribution Operator, Water Plant Operator, and Wastewater Plant Operator will be administered.

The examinations will be given at the conclusion of the annual Water School to be held on the MSU campus September 26-29. Attendance at the school is not required in order to take a certification examination. However, anyone planning to take an examination should complete a certification application AND examination registration slip before September 16, 1988 and send it to:

Water/Wastewater Operator Certification
Water Quality Bureau - Room A206 - Cogswell Building
Helena, Montana 59620 (Phone: 444-2691)

Annual fees for fiscal year 88/89 payable with application are: Class 1-$27; Class 2-$22; Class 3-$17; Class 4-$12; Class 5-$10. There is no pre-registration for Water School. Fees for the school are payable to MSU at the time of registration September 26 early a.m. Water School information will be in the August CLEARWATER.

Those who have previously submitted certification applications and fees for fiscal year 88/89 will only need to submit EXAMINATION REGISTRATION SLIPS (detachable below) with a fee of $5 per examination. PLEASE RETAIN THE UPPER PORTION OF THIS NOTICE to know the time and place of the examination. Checks should be made payable to: DHES - OPERATOR CERTIFICATION. For application materials or information contact the address or phone listed above.

EXAMINATION REGISTRATION SLIP

(Detach and return with $5 per exam by September 16, 1988)

I will take the examination(s) I have checked below:

Type	Class: 1	2	3	4	5
Water Distribution (A)	____	____	____	____	
Water Plant or Well (B)	____	____	____	____	____
Wastewater Plant (C)	____	____	____	____	

*Combination examinations are offered for 2A3B, 3A4B, 4A4B, and 5A5B and require $5 examination fee remittance only.

NAME:________________________ ADDRESS:______________________________

SYSTEM OPERATED:____

FIFTY-FIFTH ANNUAL SCHOOL
WATER AND WASTEWATER OPERATORS & MANAGERS
September 26 - 29, 1988

MONDAY - 9/26/88

8:30 - 9:30 Registration

9:30 Welcome from MSU
Welcome from DHES
Operator Certification - CEC Program
Operator Training Program
School Logistics

10:30 Microbiology for Water & Wastewater Operators

11:45 Lunch

	SESSION I		SESSION II		SESSION III
1:00	Wastewater Treatment Processes in Montana	1:00	Overview of Water Treatment Processes in Montana	1:00	Basic Math for Water & Wastewater Operators
1:45	Lift Station (Description & Operation) - What Affects Pump Output				
3:00	Break	3:00	Break	3:00	Break

JOINT SESSION

3:15 Recognizing and Correcting Cross Connections

4:15 SOS

5:00 Happy Hour - Hosted by AWWA-WPCF

TUESDAY - 9/27/88

	SESSION I		SESSION II		SESSION III
8:00	Optimizing Unit Processes in Wastewater Treatment	8:00	Water Rate Structuring	8:00	Water Treatment: Improving Finished Water Quality

	SESSION I		SESSION II		SESSION III
		9:00	Basic Calculations for Small Water & Wastewater Systems		
10:00	Break	10:00	Break	10:00	Break
10:30	Optimizing Unit Processes (Cont.)	10:30	Helpful Hints for Small Water & Wastewater Systems	10:30	Water Treatment: Improving Finished Water Quality (Cont.)
12:00	Lunch	12:00	Lunch	12:00	Lunch
1:00	Optimizing Unit Processes (Cont.)	1:00	Wells: Drilling, Formations, Maintenance	1:00	Principles of Ozonation
				2:00	Using the CPE Approach @ Water Treatment Facilities
2:30	Break	2:30	Break	2:30	Break
2:45	Optimizing Unit Processes (Cont.)	2:45	Wells: (Cont.) Pumps - Selection & Maintenance, TV Troubleshooting	2:45	Turbidity Measurement: Principle of Operation, Proper Standardization & Calibration
4:00	SOS	4:00	SOS	4:00	SOS

WEDNESDAY - 9/28/88

	SESSION I		SESSION II		SESSION III
8:00	Solids Handling & Disposal for Wastewater Facilities	8:00	Lagoons: Evaluation, Operation & Maintenance	8:00	Chlorination
9:15	Operational Techniques at the Missoula Wastewater Treatment Plant				
10:00	Break	10:00	Break	10:00	Break

	SESSION I		SESSION II		SESSION III
10:30	Operational Techniques at the Lewistown Wastewater Treatment Plant	10:30	How to Use a DO Meter	10:30	Update: SDWA Amendments
		11:00	Lagoon O & M Techniques at Conrad & Polson	11:00	Giardia
12:00	Lunch	12:00	Lunch	12:00	Lunch
1:00	Safety in Wastewater & Water	1:00	Groundwater & Sources of Contamination	1:00	Use of Polymers in Water & Wastewater
		2:00	The Underground Storage Tank Program		
2:30	Break	2:30	Break	2:30	Break
2:45	Operator Exposure to Infectious Disease	2:45	Operator Exposure to Infectious Disease	2:45	Use of Polymers in Water & Wastewater (Cont.)
4:30	SOS	4:30	SOS	4:30	SOS

THURSDAY - 9-29-88

8:00	Distribution & Collection Systems
10:00	Break
10:30	Electrical Troubleshooting
12:00	Lunch
1:00	Pump Seals & Packing
2:30	Pump & Motor Alignment
3:00	School Ends!

WHERE DOES ALL THE SEPTAGE GO?

By: Dick Pedersen
Water Quality Bureau

Whenever you ask someone why they live out of the city limits, invariably the answer will be because they do not like to depend on or pay for city services such as water and sewer. Sometimes these people are not aware of how much they do depend on these services.

One of the environmental concerns facing county and state health departments is septage disposal. Septage is defined as the liquid and solid material pumped from the septic tank, cesspool, or privy of those dwellings not served by a central sewer.

Any person engaged in the business of disposal of septage must possess a license from the Department of Health and Environmental Sciences (DHES). One of the licensure requirements is that a septage disposal site be certified by a local health officer. The purpose of this requirement is to ensure septage disposal is conducted in an environmentally safe manner.

There are many options for the disposal of septage. In Montana, the most common method is surface land spreading although hauling to municipal treatment works is becoming more and more common. As operators, managers, or administrators of wastewater treatment works you should be aware of the impact that septage is having or could have on your facility.

In order to determine impacts, one must know what the characteristics of septage are. Table 1 is reprinted from EPA's 1984 Handbook on Septage Treatment and Disposal. As can be seen from the table, septage is many times stronger than the domestic sewage coming in to the treatment works. To further demonstrate the characteristics of septage, lets look at a study conducted by the city of Helena.

From January 1985 to June 1986, the city of Helena sampled 67 loads of septage dumped to their treatment plant. The average biochemical oxygen demand (BOD_5) concentration was 9290 mg/l and the maximum was 58,000 mg/l or 49 times and 304 times the typical BOD_5 strength of Helena's incoming sewage (191 mg/l) respectively. The average total suspended solids (TSS) concentration of the septage was 19,016 mg/l and the maximum was 67,500 mg/l. This was 79 times and 281 times the typical TSS strength of the incoming Helena sewage (240 mg/l) respectively.

Now that we have an appreciation for the organic and solids strength of septage, lets look at it from a different perspective - population equivalent. Typically each person connected to a wastewater facility contributes 0.17 pounds (lbs) of BOD_5 per day to that facility. If 1,000 people are connected to a wastewater treatment facility, they would contribute a total of 170 lbs of BOD_5 per day which is calculated as follows:

$$0.17 \text{ lbs/person/day} \times 1{,}000 \text{ people} = 170 \text{ lbs } BOD_5\text{/day}$$

How many pounds of BOD_5 are there in a load of septage? If we use Helena's average septage BOD_5 concentration of 9290 mg/l and an average septage load of 1,000 gallons the following calculation can be made:

> 9290 mg/l x 0.001 MG x 8.34 lbs/gallon = 77.5 lbs BOD_5 per load of septage

The yearly population equivalent of this load is:

> 77.5 lbs BOD_5/load $\div$ 0.17 lbs BOD_5/person/day $\div$ 365 days/year = 1.25 people

This doesn't sound like much but as we all know a load of septage is not slowly dumped in to the treatment plant over one years time but rather in one big slug. So what is the daily population equivalent of this load?

> 77.5 lbs BOD/load $\div$ 0.17 lbs BOD/person/day = 456 people

This means that each 1,000 gallon load of septage dumped at a wastewater treatment facility has the same impact in terms of organic load as 456 people!

This shock loading can have many detrimental effects if the treatment facility is not designed to handle it. In the past, Helena experienced violations of their discharge permit because their facility could not adequately treat this shock load. The city therefore moved the point of septage dumping from the treatment plant to a location further up in the collection system hoping that the distance would attenuate the shock loads.

Another problem experienced with septage at treatment facilities is plugging and jamming of equipment. This occurs because of the high solids content of the septage. Screens and other primary treatment devices have been known to plug when a load of septage arrives at the treatment plant. Plugging of aerator diffusers in aerated lagoons has also occurred. In addition, odor problems from septage have been reported.

Before allowing septage to be dumped at your wastewater treatment facility you must consider the potential impacts. You must evaluate if your facility has the overall design capacity to receive the septage. In addition, you must determine if individual unit processes such as bar screens, grit chambers and aeration basins are able to handle the shock load. If you determine that your facility is able to handle the septage loading, then an equitable charge for use of your treatment facility should be levied based on the amount of septage received.

TABLE 1

COMPARISON OF SEPTAGE AND MUNICIPAL SEWAGE[a]

Parameter	Septage[b]	Sewage[c]	Ratio of Septage to Sewage
TS	40,000	720	55:1
TVS	25,000	365	68:1
TSS	15,000	220	68:1
VSS	10,000	165	61:1
BOD_5	7,000	220	32:1
COD	15,000	500	30:1
TKN	700	40	17:1
NH_3-N	150	25	6:1
Total P	250	8	31:1
Alkalinity	1,000	100	10:1
Grease	8,000	100	80:1
pH	6.0	---	---
LAS	150	---	---

[a] Values expressed as mg/L, except for pH.

[b] Based on suggested design values in Table 3-4

[c] From Metcalf and Eddy, 2nd Edition, "medium strength sewage".

WATER TREATMENT PLANT DESIGN SEMINAR

(Dr. Cleasby Comes to Montana!)

By: Michele Wityk
Water Quality Bureau

On February 19, a one-day seminar on water treatment plant design was sponsored by the Water Quality Bureau in cooperation with the AWWA Joint Education Committee. More than 90 engineers, treatment plant operators, and water treatment personnel from around the State attended the seminar at the Colonial Inn in Helena. The instructor of the course was Dr. Jack Cleasby, a world-recognized filtration authority.

Dr. Cleasby is a professor of civil engineering and Anson Marston Distinguished Professor in Engineering at Iowa State University. Dr. Cleasby is noted not only for his research but also for his varied practical experience in water treatment. He has taught short courses on water treatment at a number of locations in Asia and South America. He has also done extensive consulting work throughout the United States.

Dr. Cleasby covered the topic of filtration quite thoroughly with information and advice for designers and operators alike. Segments of his program addressed slow sand filtration, direct filtration, simple systems for small communities, declining rate filtration, and filter media backwash and underdrain considerations. It was a full day of information for everyone who attended.

Dr. Cleasby stressed the need to give small communities a water treatment plant they can easily handle, both financially and with respect to operation and maintenance. These systems must be immune to hydraulic shocks since there usually isn't a full-time operator available to continuously monitor the system. Also there should be relative ease in the inspection of the media and all other major components of the system, so that problems are more easily detected and easier to solve.

The merits of declining rate filtration as the mode of operation for a filter system were presented. Through extensive research Dr. Cleasby has found that declining rate plants generally produce better water quality and require less head loss than conventional filtration plants which are operated at a constant rate or constant water level. One regulatory issue which sometimes impedes the use of declining rate filters is the setting of a maximum filtration rate by states. If this rate is applied to the starting rate for a declining rate filtration plant, the plant is at a disadvantage when compared to the constant rate plant. This is because the constant rate plant can operate at the maximum filtration rate throughout its filter run, while the declining rate plant would use the regulated upper limit as its starting filter rate and therefore have a lower mean filter rate. Perhaps we should look at this issue more closely at our regulatory level.

Well, Dr. Cleasby's trip to Montana wasn't all work and no play! He enjoyed a pot luck dinner with Water Quality Bureau staff members, a stay at the Sanders Bed and Breakfast, and a day of skiing at Big Sky where he displayed excellent form. In the past, Dr. Cleasby has skied in Colorado whenever he gets the yearning to ski something other than the little snow-covered bumps available to him in the Midwest. Not anymore! Dr. Cleasby, duly impressed by Montana's hospitality, scenery, and skiing intends to return! And we'll be looking forward to it when he does!

Dr. Cleasby, as instructor, teaching the masses.

Dr. Cleasby, as skier, attacking the moguls.

Dr. Cleasby, with skiing buddies Alden Beard and Dr. Sanks.

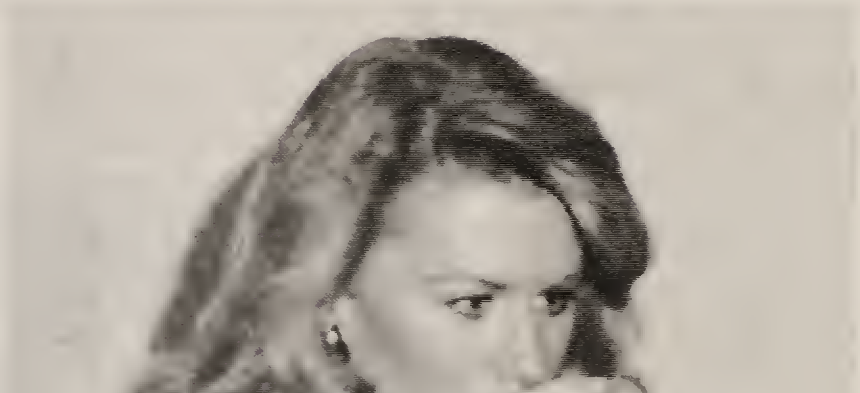
A LOOK AT THE 1988 AWWA-WPCF CONFERENCE

Governor Schwinden welcomed our guests from National - Bob Chuck, AWWA Past Chairman, Hawaii and Art Saarinen, WPCF Vice-President, Florida.

Screening for sapphires.

Select Society of Sanitary Sludge Shovelers perform initiation rites. (Barry Damschen, Warren Meyers)

Helen Raptis, KTVH TV, Helena, judging an entry in the drinking water taste contest.



Lyle Meeks, AWWA Past President, gets things rolling.

Henry Elbrecht and Charlie Dickert of the City of Helena.

MSAWWA MEMBERSHIP REPORT

Montana's AWWA has had a great beginning for 1988. With 21 new members in the last 6 months, we've increased to 190 plus 14 multi-section members. As our section grows, we are better able to provide more local benefits such as school education promotions, public information releases, and special seminars by industry experts. In addition to section activities, the National Association provides several benefits including: **Journal AWWA**, a monthly magazine of technical information and management issues covering water supply management and water research; **OPFLOW**, a monthly newsletter for water treatment operators on the practical aspects of system operations; **Mainstream**, a monthly newspaper on association and industry activities; and **Reduced** costs for national conferences, local seminars, and publications.

The AWWA Board of Directors has approved a dues increase effective January 1, 1989. This will be the first real dues increase since 1980 and is needed to support the growing organization and its programs including Small Systems, Public Information, Government Affairs, and others. Now is the time to encourage new memberships and renew your own before the increase takes place.

Welcome New Members

Doug Ayers, Miles City
J. A. Barranger, Whitefish
Steven Carlson, Whitefish
Tim Farwick, Ft. Benton
Ken Hagen, Lewistown
Terry Johnson, Columbus
Ed McHugh, Helena
David McLeod, Hamilton
Ed Murgel, East Helena
Michael Wade, Whitefish
Michael Omary, Whitefish
Steve Pilcher, Helena
James Putnam, Whitefish
Mark Richardson, Miles City
Steve Smith, Whitefish
Gary Swanson, Helena
Ray Tout, Big Sky
Allen Tudor, Kalispell
Erling Tufte, Great Falls

And Multi-Section Members Greg Hochmuht (Yellowstone Nat'l Park)
Chuck McKenzie (Badger Meters)

Thanks Recruiters

Earl Park (1), Greg Acton (6), Donna Howell (6), Bob Peccia (1)

Free Dues for Top 1988 Recruiter

The recruiter sponsoring the most new members for 1988 will get a free year of active membership on MSAWWA (or two years of affiliate membership). Membership committee members Donna Howell and Michele Wityk are not eligible for the contest, but you can get membership applications from us by calling 444-2406, or write c/o Water Quality Bureau, Room A-206, Cogswell Building, Helena, MT 59620. Applications are also available in OPFLOW and the Journal.

Join Now and Grow With Us

INDIVIDUAL

AMERICAN WATER WORKS ASSOCIATION
MEMBERSHIP APPLICATION

Complete this form and mail to:
AWWA / 6666 W. Quincy Avenue / Denver, CO 80235 / (303) 794-7711

BSCWS

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PLEASE PRINT OR TYPE

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TITLE

EMPLOYER'S NAME (if not already in mailing address)

APPLICANT'S SIGNATURE DATE

SIGNATURE OF AWWA MEMBER ENDORSING APPLICATION (Optional) ENDORSER MEMBER NUMBER

ANNUAL DUES $______

NEG Assessment* ______

Multi-Section Option (other than own) ______

Total Due $______

Check One	Grade Code	Annual Dues
☐ Active	02	$53.00
☐ Affiliate (Strictly for operator-level personnel or employees of small utilities)	06	24.00
☐ Student (Must be enrolled and carrying at least 10 credit hours)	14	15.00

*Applicants with an address in the New England Section (ME, NH, RI, VT, MA) are required to include an assessment of $26.50 with their AWWA dues.
Multi-section membership on reverse side.

Make check payable to AWWA (Canadian funds add 15%)

☐ American Express ☐ Diner's Club ☐ MasterCard ☐ Visa

Credit Card No. ______

Exp. Date ______

☐ Send invoice

If you have been a member of AWWA before, indicate dates here:

______

ALL APPLICANTS SHOULD COMPLETE THIS SECTION:
Circle the descriptions below that best describe you. The information is used in audits of AWWA readership.
Circle only ONE in each group.

1. BUSINESS AND INDUSTRY
   - A. Public Water Supply Utility – Municipally Owned
   - B. Public Water Supply Utility – Investor Owned
   - C. Governmental – Federal, State, Local
   - D. Consultant
   - E. Contractor
   - F. Private Industrial Systems or Water Wholesaler
   - G. Manufacturer of Equipment & Supplies Including Representatives
   - H. Distributors of Equipment & Supplies Including Representatives
   - I. Educational Institutions, Faculty and Students, Libraries, and Other Related Organizations
   - J. Fully Retired
   - K. Research Labs

2. JOB TITLE
   - A. Executive – Gen'l Mgr., Commissioner, Board Member, City Mgr., Mayor, President, Vice-President, Owner, Partner, Director, etc.
   - B. Management – Division Head, Section Head, Mgr., Chief Engineer, Comptroller, etc.
   - C. Engineering/non-managerial – Civil Engr., Mech. Engr., Envir. Engr., Planning Mgr., Field Engr., Systems Designer, etc.
   - D. Scientific/non-managerial – Chemist, Biologist, Biophysicist, Researcher, Analyst, etc.
   - E. Purchasing – Purchasing Agent, Procurement Specialist, Buyer, etc.
   - F. Operations – Foreman, Operator, Maintenance, Crewman, Service Rep., etc.
   - G. Marketing & Sales/non-managerial – Mkt. Analyst, Mkt. Rep., Salesman, Sales Rep., etc.
   - H. Other (describe) ______

______

CHECK FIELD(S) SERVED:
5 ☐ Water Supply Only
7 ☐ Wastewater Only
9 ☐ Both
3 ☐ Other

In some AWWA sections, a portion of the section allotment equal to 50 percent or more of the domestic subscription rate charged for the section periodical will be allocated toward a subscription of that periodical.

Dues allocated for each publication members receive:
Journal $25
Mainstream $6
OpFlow $5
Waterworld News $5

CONTROL TECHNIQUES FOR FILAMENTOUS BULKING

By: Jack Crosby
Superintendent of Water Pollution Control - Liberal, Kansas

Taken from the March 1988 issue of Splashings - A publication of the Kansas Water Pollution Control Association; reprinted with their permission

Excluding toxic wastes or mechanical and equipment malfunctions, one of the most troublesome problems that may affect the successful operation of an activated sludge wastewater plant is the uncontrolled growth of filamentous organisms.

Most commonly, filamentous organisms are bacteria that reproduce to form long chains of connected-together bacterial cells. In most activated sludge floc particles, these filament-forming bacteria provide the skeletal structure that holds the floc particle. These filaments do quite well in the absence of sunlight, low food-to-microorganism ratios, depressed pH and dissolved oxygen levels, and are often found thriving in septic sewage. Although filaments can drastically inhibit the settling process in secondary treatment units, they may be considered extended only when they protrude beyond the confines of their biomass. Often times, wastewater operators are deluded into believing that a poor settling mixed liquor is the result of too high a solids inventory. Because of this, the problem is often attacked by drastic increases in wasting. The operator feels that he/she simply has too many solids in the system, and attempts to combat that problem by wasting, without the benefit of employing proper control techniques.

Unfortunately, when solids wasting is used as the sole means of attempting filamentous control, the operator removes too many of the healthy forms of life too quickly and then discovers that a new problem has developed, i.e. a young and unstable sludge.

In any attempt to successfully deal with a filamentous problem, certain features must be recognized. Filaments will thrive, in addition to the aforementioned conditions, in a relatively narrow range of air temperatures. Generally, the seasonal changes that exhibit themselves in the spring and fall seasons encourage their growth and reproduction. However, it should also be pointed out that although the problem may be most obvious for only a few months per year, if the wastewater operator misinterprets or otherwise incorrectly attacks the problem, longer lasting biological problems may follow.

How, then, is a filamentous organism problem properly recognized? Most often, a simple 40X microscopic analysis of any good sample of mixed liquor will suffice. Most wastewater tests will provide operating personnel with adequate pictures of uncontrolled growth, and the operator has only to compare those photos with his own microscopic analysis. If a poor settling sludge is in evidence, often times these long stringy appearing organisms are the culprit. Without proper identification, however, the operator will be at a loss to determine the exact nature of the problem.

It is also very important to bear in mind, that any successfully operated activated sludge facility needs a certain number of these bacteria. However, their function is only useful when they are contained inside the biomass. Once these organisms extend beyond the boundary of the floc particle, particularly if they are long enough to contact filaments from other floc particles, they will inhibit sludge settling.

Occasionally, plant operators will literally be able to view filamentous organisms without the aid of a microscope, and will mistakenly believe they have a grease or oil contaminant in their treatment plant. It is not too uncommon for large amounts of scummy, greasy foam to appear atop secondary treatment systems, including the surfaces of an activated sludge aeration basin and secondary clarifier. What many operators interpret as a grease, fat, or oil problem will actually be only added evidence of an overabundance of filamentous organisms.

Having discussed identification techniques, problems associated with filaments, and conditions for their growth, what are some solutions?

There is a wide variety of solutions that may be employed. Many operators have attempted to increase their dissolved oxygen (DO) levels in their aeration basins as a means of combating filamentous and/or bulking problems. If it is commonly accepted that higher oxygen levels help promote the sludge settling process, just as low levels eventually inhibit it, plant operators have sometimes achieved success by raising their oxygen levels to 3.0 mg/l to 5.0 mg/l. This technique, however, may not represent a good, long term solution, and it is usually only successful under very controlled conditions.

Attempts have also been made to control bulking by raising pH levels in aeration systems. It is commonly accepted that an extremely old sludge or one that has a depressed pH, is a haven for filamentous growth. If alkaline buffers have been employed with little success (low pH's are considered to be anything below the 7.2 - 7.4 range), other techniques should be attempted.

Low nutrient levels are also strong suspects in permitting uncontrolled filamentous growth. Basic lab testing will help determine nitrogen, iron, and phosphorous levels in activated sludge systems. If the operator discovers unusually low levels of nitrogen, anhydrous ammonia has been applied with some success. It must be noted, however, that even acceptable levels of nitrogen and iron may not necessarily control filamentous growth. If most all other conditions are ripe for continued expansion of the organism, the operator will eventually have to combat it. It has already been noted that the presence, in large numbers, of filaments already exists in any healthy activated sludge. In fact, without their presence, operators would find it nearly impossible to form a biomass network in the first place.

A poor solution, but one that has been recommended in some texts, is to completely waste the system of virtually all of its solids. Unfortunately, the operator will be left with a very turbid effluent and most probably be in violation of health department guidelines. Additionally, if this approach is tried, it assumes that the conditions that created the original problem will not readily return.

Although it is a strong toxic agent, chlorine may well be the most economical and fastest acting tool for the operator to employ. Through personal experience, it has always proven to be very effective, and if applied properly, it has the added advantage of often times enabling the operator to control a rising sludge blanket in secondary sedimentation units.

Despite the fact that chlorine is a well established agent for controlling filamentous bulking, many operators seem reluctant or uncertain of how best to employ it. Also, if consideration is given to its use, it is essential to have at least a basic understanding of acceptable application rates and, just as importantly, reasonable expectations of the time that may be involved.

A good approach to use is an application formula of 2-3 pounds of chlorine per 1000 pounds of mixed liquor volatile suspended solids (MLVSS) added to the return sludge flow. If this dosage proves to be insufficient, larger doses may be attempted, but wastewater personnel should bear in mind that, unlike adding polymers or other settling agents, they should not abandon the application of chlorine if they do not witness immediate positive results. Too often, operators will begin a program of chlorine application to their return sludge, only to suspend it if positive results are not in evidence within hours or days.

Particularly in extended aeration plants where higher solids inventories are common, the operator may choose to hasten the effectiveness of the chlorine by wasting to lower the return sludge solids concentration. This approach has the added advantage of potentially creating a younger sludge, depending on the amount wasted, and in some cases, it will help promote the settling process. Careful attention, however, should be paid to control parameters when increased wasting is contemplated.

A common concern among many operators is whether the application of chlorine to an otherwise totally biological system will have an adverse impact on the microbes in the activated sludge. Fortunately, long before there are any adverse effects to the more desirable microorganisms, the chlorine will shrink and detach the filaments. It is important to consider that as improvement becomes apparent in the settling process, the operator should begin to rely on microscopic sludge analysis. If the application procedure is carried too far, the chlorine will begin to breakup the very filaments that are holding the biomass together.

It should be noted that in a few cases, air temperature fluctuations are so pronounced that the application of chlorine appears to have little effect. In cases of this sort, the operator should remember that excessive filamentous growth is most prone to occur in a relatively narrow temperature range. Once this range is exceeded, or temperatures fall below the optimum, the filament is further impeded.

Lastly, consideration should be given to the fact that the continued reoccurrence of extended filamentous growth is often symptomatic of some basic deficiency in a particular activated sludge system. However, from a practical standpoint, at least until the operator is able to determine the exact underlying cause, chlorine should prove a most useful aid.

AERIALLY APPLIED FIRE RETARDANTS

WHAT ARE THEY?

By: Donna Howell
Water Quality Bureau

Have you ever wondered what is in that red stuff you see dropped onto range and forest fires by the Forest Service? An operator in Ronan posed that question after a fire retardant had been used in close proximity to the city's watershed. USDA's Intermountain Fire Sciences Laboratory in Missoula and the two chemical companies supplying most of the retardant used in Montana provided some informative answers for water supply operators.

According to Dave Blakley of the Fire Lab., the retardants are water based solutions of two compounds; diammonium phosphate and/or ammonium sulfate. These compounds may sound familiar because they are also commonly used as farm fertilizers, but they are dropped on fires in lower concentrations per unit area than what is used in agriculture. Iron oxides (rust) are used to produce the characteristic red color necessary for tracking treated areas by the aircraft crew. The retardants also contain minor amounts of proprietary additives such as corrosion inhibitors, thickening agents and a preservative.

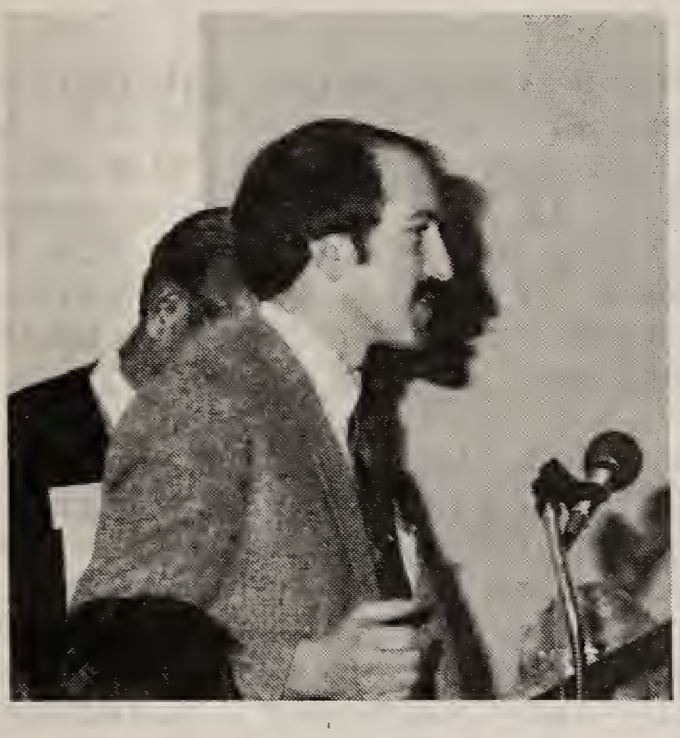
Although both products are similar, the chemical companies keep the exact ingredients of their proprietary additives a manufacturer's secret. The companies did provide the following information on their environmental impact and general content. The corrosion inhibitors include a flow conditioner also found in table salt, and they do not contain heavy metals, carcinogens or the compounds used in foam-type retardants. The thickeners are made of guar gum, a sugar used in food products such as ice cream. The preservative is needed to inhibit bacterial growth while the retardant is stored in solution, but it is very dilute when the retardant is applied to a fire.

All of the retardants used in Montana have been tested for acute oral toxicity and toxicity to the eyes, nose, skin, and fish fry and are rated as non-hazardous. Unless the chemicals are accidentally dropped directly in a stream or lake there is generally little environmental effect. If a direct surface water hit does occur, fish fry may be killed by ammonia poisoning for 100-200 feet downstream depending on water flow and subsequent retardant dilution. Because these chemicals are also used as fertilizers, it is not surprising that plant growth in drop areas can be promoted and algae blooms may occur in ponds and lakes. Significant retardant leaching from soil to water isn't likely due to their absorption as nutrients by plants and other organisms.

Cecilia Johnson, also with the Fire Lab, attributed the fire retarding effectiveness of these compounds to their ability to lower the temperature at which the fire's fuel burns. By lowering the temperature, the retardants reduce the radiant energy generated by the fire. This prevents the fire from spreading and containment is enhanced.

1988 AWWA OPERATORS MERITORIOUS SERVICE AWARD

By: Denise Ingman



Mike Patterson is the recipient of the 1988 Operator's Meritorious Service Award. This highly prestigious award was made during the 1988 AWWA/WPCF Conference in Helena in March. The award can be made on an annual basis to an operator making consistent and outstanding contributions in the water treatment or water distribution field.

Mike is the operations manager for Butte Water Company and has been with the firm for 12 years. The Butte water system is probably one of the most complicated and intricate water systems in the state. Unusual problems of supply and distribution exist due to the geography of the community, which is nearly surrounded by the Continental Divide. Water is brought across the Divide at two separate locations after being collected from three different sources from both the Missouri and Columbia River Systems. There are over 82 miles of transmission main of which a part is wood first placed in the system in the late 1800's. Within the distribution system there are seven separate pressure zones due to a difference in elevation of almost 1000 feet. In the distribution system alone, there are over 500 leaks in an average year.

In order to resolve the problems of such an old, antiquated system both in terms of water quality and construction, Mike is working diligently on a study committee to resolve the problems of the current water system. Twelve different alternatives are being studied from which one will be chosen and a ten-year master plan will be developed. In addition to the study committee, he is also actively involved in a citizen's committee formed by concerned community members who want to better understand the water system problems facing the community.

Mike joined AWWA April 1, 1976. He contributed his time working on several committees and has recruited many members. He was elected to the Montana Section Board of Directors in 1982 and proved to be an aggressive and dedicated chairman from 1986-1987.

Mike is a native Montanan, born in Divide, Montana. He attended grade school there and graduated from Butte High. He studied engineering for two years at Montana Tech and graduated from Montana State University in Agriculture Production, while attending school on a ski jumping athletic scholarship. In addition to his professional interest in the water industry, he is a licensed pilot, enjoys snowmobile hill climbing and drag racing, is a member of the Elks and the local handball association. He has been married for twelve years and has two children.

Mike, the Butte Water Company, all of us here at the Water Quality Bureau and your fellow members of AWWA are extremely grateful for your contributions and dedication to the water industry. Thanks and congratulations!

ATTENTION

WASTEWATER PROFESSIONALS

The Montana Water Pollution Control Association (MWPCA) was organized in 1944 and soon thereafter affiliated with the Federation of Sewage Works Association now known as the Water Pollution Control Association (WPCF). If you are not a member and are associated with wastewater in any way believe me **YOU ARE MISSING OUT!!** For about $1.83 a month or about 1¢ per working hour you can latch on to some of the most current and most useful information associated with our profession.

For over 60 years, WPCF has been in the business of developing and disseminating information concerning the nature, collection, and treatment of domestic and industrial water. WPCF is a non-profit, educational organization comprised of water quality specialists from every profession in the field. The Federation represents civil, and environmental engineers; biologists; bacteriologists; local and national government officials; treatment plant operators; laboratory technicians; chemists; students; teachers; industrial technologist; and equipment manufacturers/distributors.

Membership in the WPCF brings with it a great number of benefits. Whatever your role in the water quality industry, we have a membership package which is tailored to meet your professional needs. The following benefits will be available to you if you choose to join.

JOURNAL WATER POLLUTION CONTROL FEDERATION

The JOURNAL is widely recognized as the most authoritative publication in the field of water quality.

OPERATIONS FORUM

The Forum is the first monthly magazine dedicated exclusively to the needs of operations and maintenance personnel and others involved directly and indirectly with wastewater treatment facilities. The Forum covers topics on pumps, collections systems, safety, plant management, and more!

THE BENCH SHEET

This twelve-page, bi-monthly newsletter covers water and wastewater laboratory topics.

HIGHLIGHTS

The Federation's monthly newsletter, Highlights, keeps you up-to-date on current events in the field, happenings at WPCF, and members "on the move."

WASHINGTON BULLETIN

A periodic newsletter covering legislative issues and topics of interest in the water quality industry, the Bulletin covers topics such as grants, funds, Superfunds, Clean Water Act, RCRA.

SAFETY BULLETIN

This quarterly bulletin is aimed at promoting safety awareness throughout our field. The Safety Bulletin features articles about hazards in the water pollution control field.

JOB BANK

You can subscribe to a newsletter listing jobs in the wastewater field all over North America. You may obtain a sampling of what jobs are listed by calling our JOB BANK hotline 1-800-556-8700 after 6 p.m. Eastern Standard Time.

WPCF GROUP INSURANCE

Members may request coverage in the highly competitive WPCF Group Insurance Program.

EDUCATION AND TRAINING

WPCF offers continuing education units (CEU's) for successful completion of Federation training programs and jointly sponsored workshops/seminars. Through joint projects with Environment Canada, the Association of Boards of Certification and other organizations, WPCF publishers audio-visual training courses for both entry and advanced-level training.

GOLD/SILVER CARD

The MemberCard program is available to WPOF members in the form of the Gold and Silver MemberCard which offers superior premium MasterCards with high credit lines, valuable discounts and numerous FREE services for today's busy professional.

TECHNICAL INFORMATION

The Federation publishes over 90 books and audio-visual courses dealing with water pollution control issues. As a member, you will receive a substantial discount on purchases.

HONORS AND AWARDS

As a WPCF member, you will be eligible to receive special recognition for your contribution in the water quality industry and/or to the Water Pollution Control Federation.

MCI LONG DISTANCE TELEPHONE DISCOUNT PROGRAM

This member service program offers WPCF Corporate, Contractor, Consultant, and Associate Members an opportunity for a special 10% volume discount savings off MCI's already low commercial long distance rates.

ANNUAL CONFERENCE

WPCF's Annual conference and Exhibition is the largest gathering in the U.S. devoted solely to wastewater treatment and water pollution control issues.

GOVERNMENT AFFAIRS

Through personal contact with U.S. EPA officials and congressional staff, WPCF members are actively represented in Washington and contribute to a sound national water quality policy. The Federation also is an Information source for members with specific questions about federal government policy and activities.

COMMITTEE INVOLVEMENT

Approximately 1,000 WPCF members serve on one or more of the Federation's 50 committees, and form the working membership nucleus of the organization.

PUBLIC EDUCATION

Greater public awareness of the role, function, and necessity of clean water is a primary mission of the WPCF. Special publications and programs on water quality are designed to keep the public informed.

For more information contact your membership chairman Darrell Langford by phone 449-7026 or 442-9920 ext. 456 or by writing to 1708 Custer Avenue, Helena, Montana 59601.

Membership Application

Water Pollution Control Federation
601 Wythe Street
Alexandria, Virginia 22314-1994

Association
Montana Water Pollution Control Association

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1 - Less than High School
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☐ **Active**		☐ **Operations Division**		☐ **Student**		☐ **Corporate**	
For individuals involved or interested in the advancement of knowledge pertaining to water quality.		For individuals working on a day-to-day basis (or retired from) in a wastewater collection, treatment, or laboratory facility.		For individuals enrolled at least half-time in a college or university.		For companies engaged in the design, construction, operation or management of water quality systems.	
Dues	$ 55.00	Dues	$ 22.50	Dues	$ 19.50	Dues	$ 180.00
Journal	Included	*Journal*	☐ $30.00	*Journal*	Included	*Journal*	Included
Highlights	Included	*Highlights*	☐ $15.00	*Highlights*	Included	*Highlights*	Included
Forum	☐ $12.50	*Forum*	Included	*Forum*	☐ $12.50	*Forum*	Included
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WPCF, Member Records
601 Wythe Street
Alexandria, Virginia 22314-1994

For more information, call (703) 684-2452

Postal Requirement: Dues allocated for publications when included in membership: *JWPCF* — $15; *Highlights* — $3; *Operations Forum* — $5.

RAINBOW DAM IS 1988 WATER TASTE TEST WINNER

A new Water Taste Test winner was selected at the 1988 Joint MSAWWA/MWPCA Conference. In this second annual taste-off Rainbow Dam unseated last year's winner, the City of Great Falls, from a field of 19 entries.

Entry into the taste-off was open to any public water system and participants represented both large and small utilities using a variety of sources. Samples from wells, springs, and filtered and unfiltered surface water supplies were submitted and judged against one another on the basis of taste alone. Preliminary judging narrowed the field to 5 finalists, with final judging provided by Jill Sundby from Helena's newspaper, The Independent Record; Helen Raptis, KTVH TV, Helena; Art Saarinen, WPCF Vice President; and Robert Chuck, AWWA Immediate Past President.

Many thanks to those systems that participated in this years' event. Judging wasn't easy since all entrants were very close right down to the finals.

Congratulations Rainbow, you had a lot of tough competition!

AMERICAN WATER WORKS PRESENTS AWARD TO HELENA STUDENT FOR OUTSTANDING RESEARCH

By: Denise Ingman, Water Quality Bureau

In honor of Congress' designation of National Drinking Water Week May 2-8, The Montana Section of the American Water Works Association presented an Outstanding Achievement Award to Allene Whitney for her research and resulting paper entitled A Study of the Effects of Toxic Anabaena flos-aquae on Daphnia pulex. Allene, who will be a senior at Capital High School in Helena this fall, completed her research during the summer of 1987 at the Canyon Ferry Limnological Institute under the direction of Marilyn and Gil Alexander, co-directors of the Institute. Allene wrote her paper under the guidance of Tom Pedersen, Capital High Biology Teacher and Institute Instructor.

Allene's paper is of particular interest to those of us in the water industry. There have been 7 documented blooms of toxic algae in Montana, including Canyon Ferry Lake, Lower Jocko Lake, Hebgen Lake, and Nelson Reservoir. These toxic algae have killed livestock in Montana and pose a threat to public water supplies. The results of Allene's work would enable water plant operators to quickly screen their water source for potent toxic algae.

Of the 150 papers submitted to the Intermountain Region Junior Science and Humanities Symposium in Salt Lake City, Allene's was one of 20 selected for presentation. Her paper placed first in that competition and on May 19, Allene presented her paper at the National Symposium in Florida, capturing second place. Allene also presented her findings and placed first at the conference of the Montana Junior Academy of Science in March. She will move on to the national competition next spring.

The Montana Section of AWWA also wishes to recognize other students in Montana who have earned awards or other national recognition for their work at the Institute through one or more summers of study in water quality and water analysis. These students include Gwen Gray, Kim Gilleland, Liesl Strickler, and Jeff Berry all of Helena, Stephanie Richardson, Missoula, and Gard Gershmel, Winnett.

A STUDY OF THE EFFECTS OF TOXIC ANABAENA FLOS-AQUAE ON DAPHNIA PULEX

By: Allene Whitney
Capital High Student, Helena

On June 9, 1987 seventeen cattle were found dead on the north side of the Grayling Arm of Hebgen Lake. The Veterinary Research Lab in Bozeman determined the cause of death to be a toxin released into the lake water by Anabaena flos-aquae, a species of blue-green algae. Toxins produced by blue-green algae can be a cause of death or illness to nearly any mammal, bird, or fish that ingests them in great enough concentrations.

When water is suspected to be toxic, a sample is sent to the Veterinary Research Lab where it is filtered and one milliliter is injected into the peritoneal linings of two mice. The test mice are observed for approximately 6 hours, and if they die within this time period the water sample is declared toxic. This process, however, can be expensive, inconvenient, and time-consuming. During the time in which a water sample is sent to Bozeman and tested, a bloom of toxic algae may be carried by the current to a new location in the lake or the level of toxicity may change.

The purpose of this study was to find a more efficient, expedient, and less costly method of testing for algal toxicity. A possible solution presented itself as the result of an incident at the Montana Water Quality Bureau. Several toxic water samples from Hebgen Lake were experimentally mixed into cultures of Ceriodaphnia. It was discovered that Anabaena toxin would harm these invertebrates. Utilizing that information in this study, a new test was developed in which the mortality rate of Daphnia pulex placed in a water sample determined algal toxicity.

Daphnia, commonly known as water fleas, are water-dwelling crustaceans in the order Cladocera. They are only a few millimeters in length and their bodies are enclosed in a clear bivalve shell. Daphnia feed on algae, protozoa, bacteria, and organic detritus. They provide an important source of food for fish such as the kokanee salmon and other organisms such as Hydra, flatworms, Stentor, and midges.

During the summer when food is plentiful and conditions such as water temperature and dissolved oxygen are favorable, Daphnia reproduce parthenogenetically. Eggs are produced in the dorsal brood pouch and develop there in as little as two days. When released,each is a female miniature of the adult. When environmental conditions begin to change for the worse, as at the beginning of winter, some of the eggs produced develop into males. An egg of larger size develops in the ovary of each female. These larger eggs, which are fertilized by the males and laid, can survive an entire winter to hatch in the spring as females and begin the cycle again.

Anabaena flos-aquae is a species of algae in the phylum Cyanophyta, or blue-green algae. In open fresh waters, blue-green algae are the only known natural source of toxicity potent enough to kill mammals. The conditions which cause algal species to release toxin into the water are unknown, but a toxic bloom is often related to elevated water temperatures, high concentrations of nutrients or minerals in the water due to run-off, or low enough rainfall that these nutrients and minerals are not diluted.

METHODOLOGY

Daphnia pulex were taken from Canyon Ferry Lake and cultured in an aquarium containing a half-gallon of water from the same site. One-half to three-quarters of a teaspoon of ceriodaphnia chow was added to the culture every other day. This ceriodaphnia chow, prepared at the Water Quality Bureau in Helena, contained cerophyl, commercially-available trout chow, and baker's yeast. The Daphnia culture was kept in a dimly lit area, and its temperature was approximately 66 degrees Fahrenheit.

Water samples that were used as controls were obtained at the same site as the Daphnia pulex. These samples were accepted to be non-toxic because there had been no recent major bloom of blue-green algae and no history of toxicity at the site. The two controls used were:

1. Canyon Ferry Lake water from which the algae had been removed by filtration through a plankton net

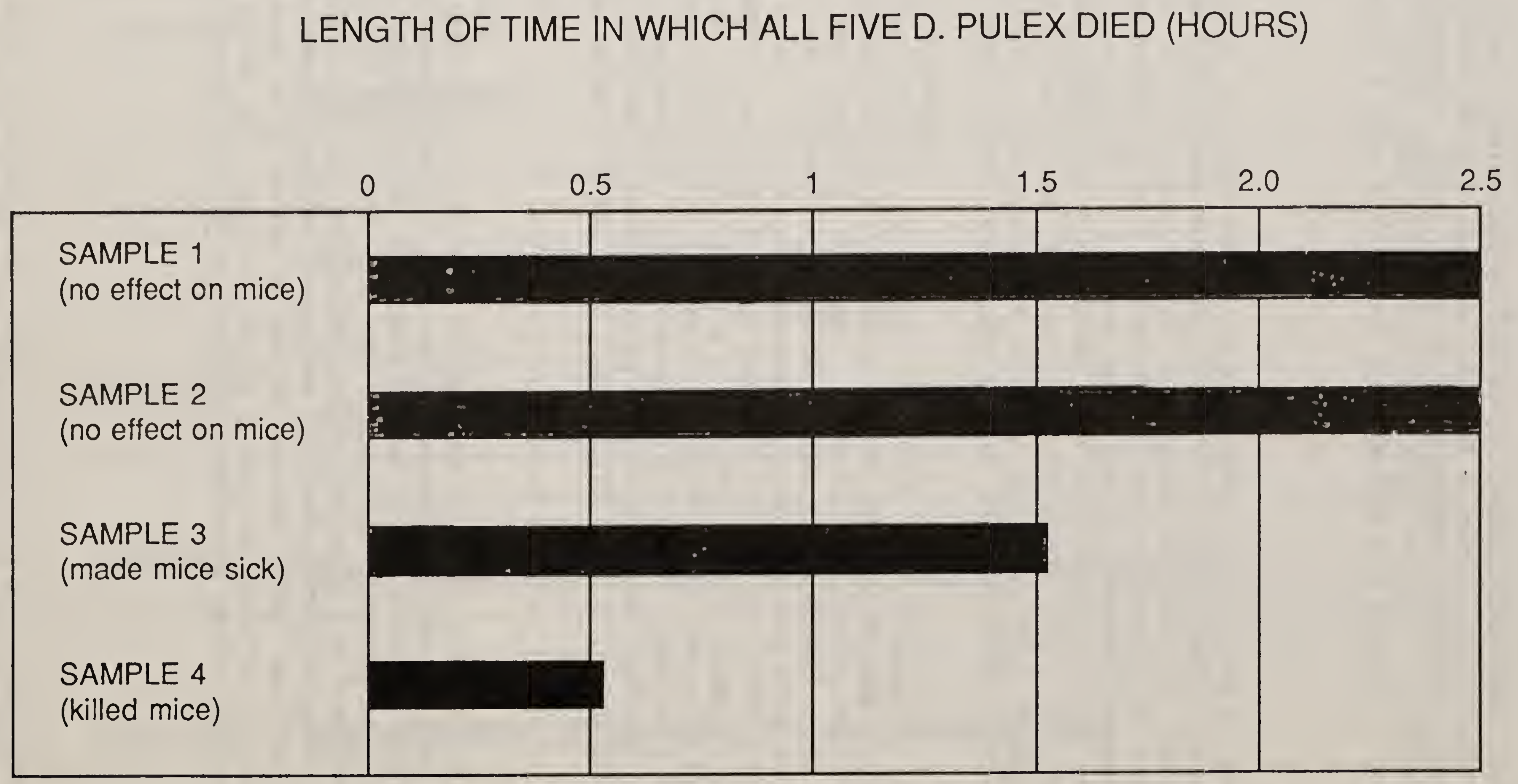
2. Canyon Ferry Lake water from which the algae had not been removed. Lyngbya, a blue-green alga that is not often toxic, was predominant.

Five water samples were obtained from the Grayling Arm of Hebgen Lake, and a sixth water sample was obtained from an area in Hebgen outside of the Grayling Arm. Four of these samples with the widest range of turbidity and location were sent to Bozeman to be tested with mice. This gave a basis for comparison to the Daphnia pulex test. Upon receiving results from Bozeman, all six Hebgen Lake samples were tested with Daphnia pulex utilizing the method which is described in the following paragraph. The results of the tests using mice were compared to the results of the tests using Daphnia pulex (Figure 1).

The first step of the testing procedure was to place a 10-ml water sample into a test tube. Then the water temperatures of the sample and the Daphnia culture were compared. If a large difference was noticed, the temperature of the sample was changed to within two degrees Fahrenheit of the culture's temperature. This insured that the Daphnia were not killed by a severe change in water temperature when they were transferred from the culture to the test tube. Five Daphnia pulex were then placed in the sample, and the time was recorded. Every five to ten minutes a record was made of the current time and the number of Daphnia that had died. After the first half hour, the intervals between observations were increased to fifteen or twenty minutes. If and when all five Daphnia had died, a final time was recorded. This method was also used in testing the controls.

To demonstrate the precision of this method, three samples and two dilutions of samples were each tested twice with Daphnia pulex (Figure 2). Sample A consisted of 10 ml of water from the narrows of the Grayling Arm. Sample B was a 1:1 dilution, consisting of 5 ml of water from the narrows, and 5 ml of Canyon Ferry Lake water. Sample C consisted of 10 ml of water from the north end of the Grayling Arm. This sample had been sent to Bozeman, and is also referred to

(FIGURE 1.) – COMPARISON OF WATER TOXICITY TESTS USING MICE AND DAPHNIA PULEX



as Sample 4 on Figure 1. Sample D was a 1:1 dilution consisting of 5 ml of water from the north end of the Grayling Arm and 5 ml of Canyon Ferry water. Sample E consisted of 10 ml of water from another location on the north shore of the Grayling Arm.

DISCUSSION

Controls

Five *Daphnia pulex* were placed in 10 ml of a control sample of Canyon Ferry Lake water, from which the algae had been removed by filtration through a plankton net. All five *Daphnia* were still active at the end of nine hours, when the test was discontinued. The second control contained unfiltered Canyon Ferry Lake Water in which *Oscillatoria* was the predominant algal species. The five *Daphnia* in this control were active until the test was discontinued shortly after five hours of testing. The *Daphnia pulex* that were placed in the controls adjusted well to the restricted conditions of space and dissolved oxygen in the test tube. The presence or absence of non-toxic algae seems to have no affect on the survival of *Daphnia pulex*.

Hebgen Lake water samples

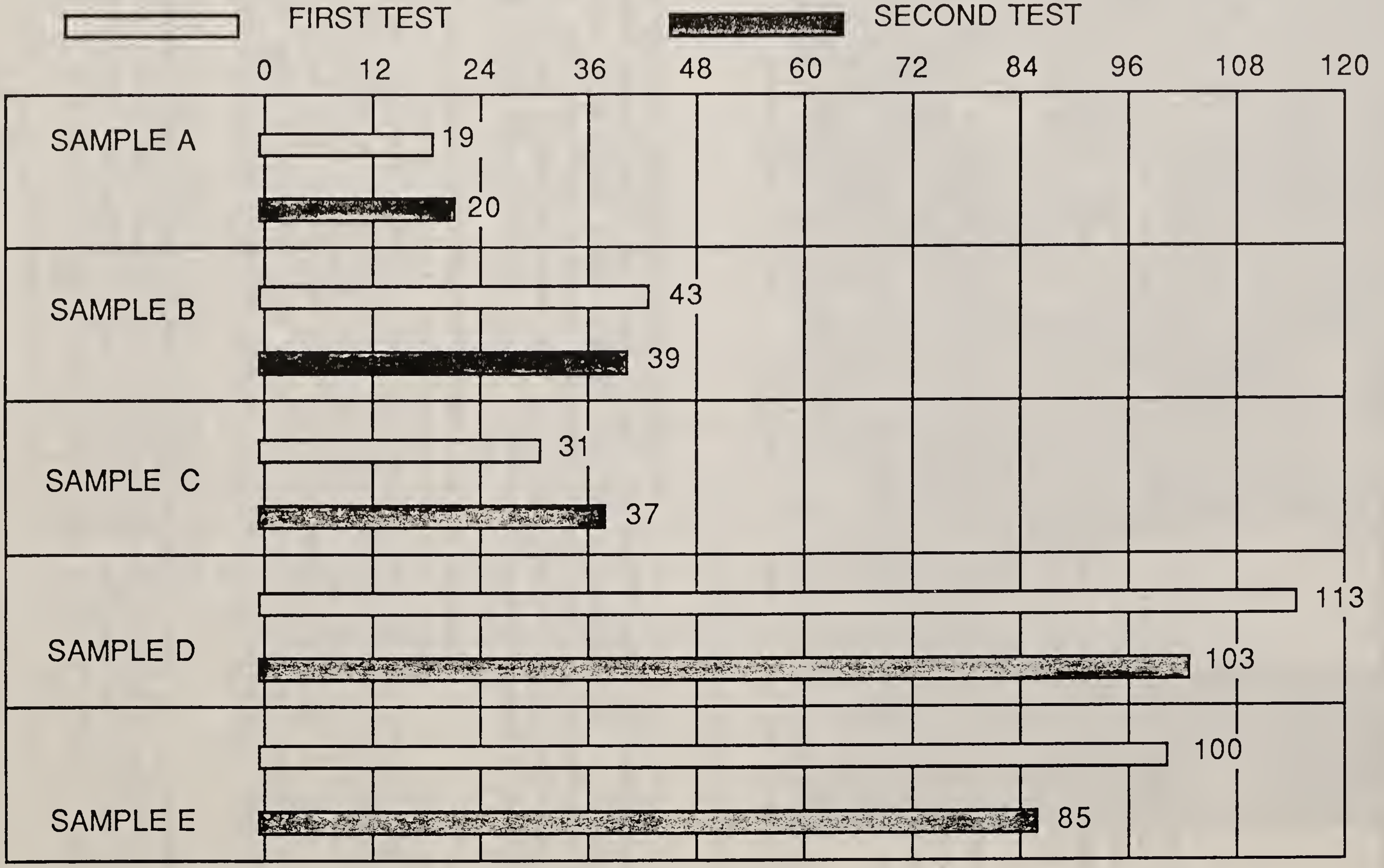
Four of the Hebgen Lake water samples were tested with mice and with *Daphnia pulex*. The results of these tests were compared and are shown on Figure 1. The results of these tests were compared and are shown on Figure 1. Samples 1 and 2 had no effect on the test mice within 24 hours. *Daphnia pulex* that were placed in these samples were not affected after 2 1/2 hours, and at that time the tests were discontinued. Sample 3 reportedly "made the mice sick"; this sample killed all five *Daphnia pulex* after 1 1/2 hours. Sample 4 killed the test mice and was confirmed to contain toxic *Anabaena flos-aquae*. The five *Daphnia* that were placed in this sample died within 31 minutes. Three of the Hebgen Lake water samples were used to demonstrate the precision of the testing method. Two of these samples were also diluted in order to study the affect of lower concentrations of toxin (Figure 2).

Each sample shown on Figure 2 was tested twice with *Daphnia pulex* using the method previously described. The length of time in which all five *Daphnia* of each test were observed to have died is shown by a horizontal bar. The result of the first test of each sample is illustrated by a yellow bar, and the result of the second test is illustrated by a green bar. The differences between two tests of any one sample ranged from a one-minute difference occurring between the tests of Sample A, to a fifteen-minute difference between the tests of Sample E. None of these differences exceeded the 15-20 minute intervals between observations. The results of these tests indicate that the testing method is very precise.

CONCLUSIONS

A bloom of toxic algae in a lake can affect many people and animals. Before toxicity is recognized, stock may drink from the lake and die. Many other animals may also be affected. After toxicity is confirmed, stock are removed from the area and ranchers can not use the lake as a water source until the toxicity has abated. Often a toxic lake is posted for recreational use, causing

(FIGURE 2) – LENGTH OF TIME IN WHICH ALL FIVE D. PULEX DIED (MINUTES)



a problem to all who visit it or have homes and businesses on its shores. Tests of potentially toxic water samples must therefore be timely, precise and accurate, and it is important that the information from those tests be made public as soon as possible.

In this study, a new test was developed which used Daphnia pulex to determine toxicity of Anabaena flos-aquae. One of the most evident advantages of this test over the current test using mice is its convenience and expedience. A culture of Daphnia pulex can easily be transported to a lake which is suspected to be toxic, and a water sample can be tested immediately.

Furthermore, the results of tests of Sample 3, (Figure 1), indicate that Daphnia pulex are much more sensitive than mice to levels of water toxicity. This sample did not kill the test mice, but the five Daphnia placed in this sample died within 1 1/2 hours. Because of this extra sensitivity, the test using Daphnia pulex involves a shorter length of time and will identify lower levels of toxicity than the test using mice. The variations in the results of tests shown on Figure 2 were small, not exceeding the length of time between observations. The test using Daphnia pulex is quite precise.

The final conclusion which can be drawn from the above statements is that the toxicity test using Daphnia pulex was more efficient, convenient, and less expensive than the test using mice. Daphnia are easily cultured, and can be transported to a lake where tests can be conducted immediately. In addition, Daphnia's greater sensitivity to lower levels of water toxicity could possibly be utilized to warn of impending fatal toxicity.

SUMMARY

The toxicity of blue-green algae in Montana's waters is a serious problem. Livestock, pets, and other animals are killed by drinking affected water, and the toxin can cause gastroenteritis in humans.

In order to determine algal toxicity, a water sample must be sent to the Veterinary Research Lab in Bozeman to be injected into test mice. This process is inconvenient and time-consuming. In this study, an efficient new field test was developed which used Daphnia. The mortality rate of five Daphnia pulex placed in a ten-milliliter water sample determined algal toxicity.

Daphnia are inexpensively cultured and can easily be transported to a lake which is suspected to be toxic, where tests can be done immediately. The results of this study indicate that daphnia are more sensitive than mice to low levels of toxicity. The use of the new test may reveal that Daphnia can detect water toxicity more quickly, permitting ranchers and recreationists to be warned of the water's condition before death or illness occurs.

MWPCA AWARDS KRISTI KLINE FEDERATION AWARD

The William D. Hatfield award was awarded to Kristi Kline during the March 1988 MAWWA/MWPCA joint convention in recognition of her performance as an operator of a wastewater treatment plant. The award is given to association members of the Water Pollution Control Federation who exhibit outstanding performance as an operator and for demonstrating distinguished professionalism.

Kristi has worked for the City of Havre as superintendant of the wastewater plant for almost eight years. The plant is a complete mix activated sludge mechanical treatment plant that might best be characterized as "tempermental" and difficult to operate. Even though the plant had a history of compliance problems the facility has performed very well under the supervision of Kristi during her tenure.

Kristi has also worked in the water and wastewater departments at the City of Laurel. Her academic career includes a BS in Microbiology from MSU and an associate degree in water and wastewater technology from Northern Montana College. She was a recipient of the MAWWA/MWPCA scholarship while at Northern. Kristi is active in the Montana Water Pollution Association in both committee work and working through the board chairs. She was president of the association in 1986-87.

Congratulations Kristi!!

MANY TRAINING SEMINARS AVAILABLE

By: Denise Ingman
Water Quality Bureau

Since January 1st of this year 26 operator training seminars have been sponsored by the Water Quality Bureau, Montana Rural Water, the Joint Education Committee, and Northern Montana College. On an average, 2-3 seminars per month are held throughout the state. In addition to operator topics, we sponsored a session for design engineers in February and for public works supervisors in July, both well attended.

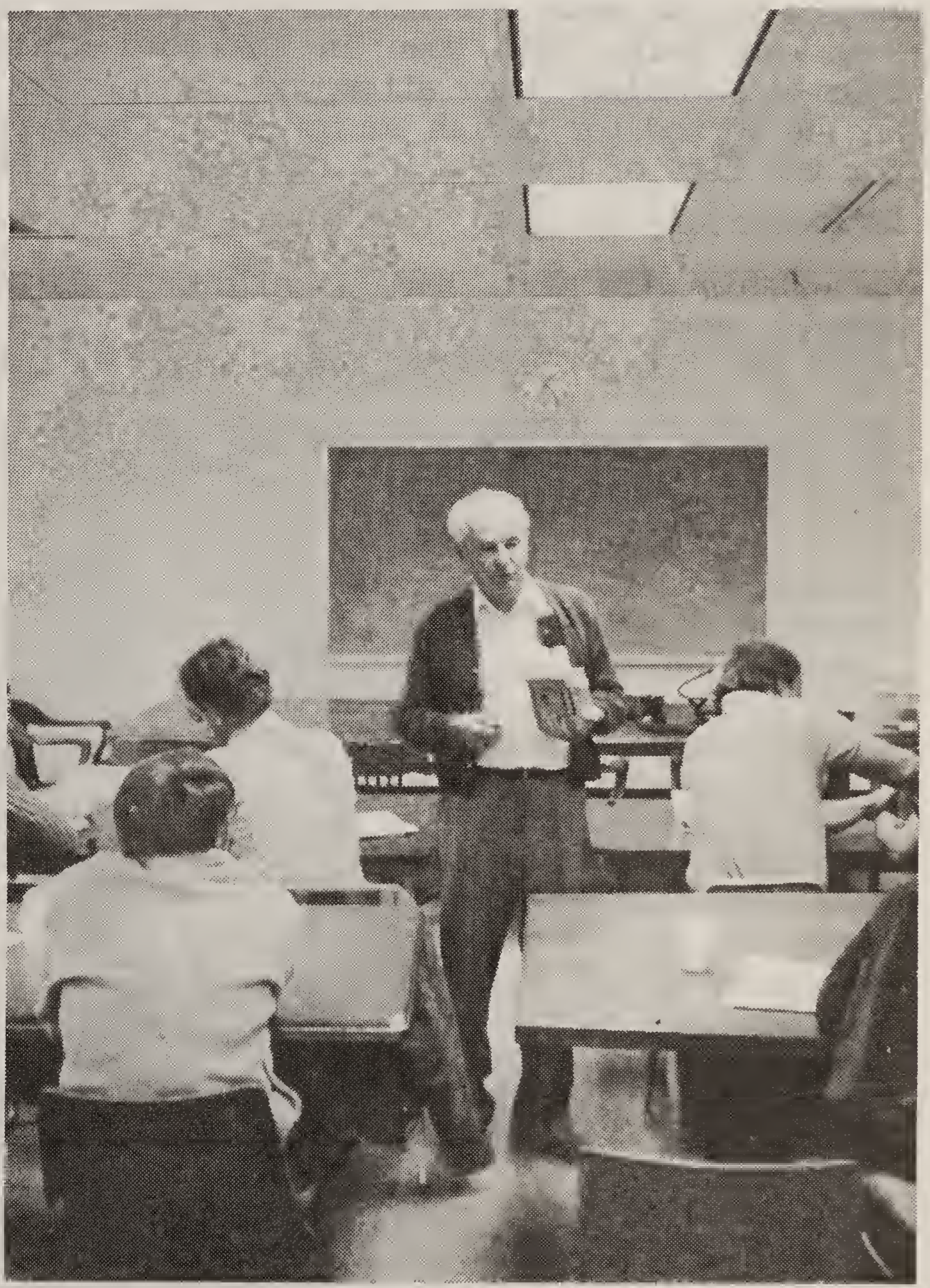
In October the Water Quality Bureau will once again coordinate and finalize the schedule of operator training in Montana for 1989. All organizations sponsoring training within the state will be contacted for coordination purposes. A calendar of events will be published and mailed to certified operators by January 1.

If you have training needs you would like us to address, this is the time to let us know. Thanks for all your past support and interest!

Bill Bahr discusses the importance of
safety in water and wastewater facilities.

Joe Scheeler gets everyone involved!

Ken Johnston demonstrates chlorinator head repair.



OPERATOR EXCELLENCE IN HAVRE

By: Kristi Kline
Wastewater Treatment Plant, Havre

Randy Christofferson started with the City of Havre in 1962 as a mechanic for the city shop. He became an operator for the wastewater treatment plant in 1974 and took over plant maintenance in 1978. He has worked under 6 different supervisors, 3 different public works directors and 5 different mayors for the City of Havre.

Randy has an extensive background in mechanics and equipment that has been greatly appreciated at the Havre Wastewater Treatment Plant. He has many innovative ideas for solving maintenance problems and improving maintenance conditions for the various pieces of equipment we have (some pieces which date back to 1950). He runs an up-to-date maintenance schedule for keeping our equipment running smoothly. Many times you will see him listening for noises on pumps just as a doctor listens to a person with a cough.

Randy is from Whitewater, Montana. His parents were immigrants from Norway that farmed in the area. He has many tales from his childhood of the wagon rides and the long walks into town in the cold winters of Montana, and the makeshift "downhill skiing" they attempted on the farm hills. He served in World War II and he worked for Marias Equipment in Chester for many years previous to working for the City of Havre. He also worked for the Northern Montana College Physical Plant from 1971 - 1974.

He and his wife Mavis have 3 children. He enjoys camping and loves to fish but doesn't care to eat any of the fish! It's hard to believe that a Norwegian won't eat fish!! I do believe he will eat lutefisk though.

The City of Havre appreciates the years of service and contributions Randy has given and thanks him for a job well done.

HELP! MY CHLORINATOR QUIT WORKING!

By: Ken Johnston
Water Services Company, Helena

One morning you make your usual check of the chlorination system and find that something has gone wrong. The loss of chlorine in the water supply can be an emergency of the first order and you need to know where to look for the problem. Here are some ideas! These are not the only problems that can occur but are probably the most common.

Most of the chlorinators in use in Montana are of the vacuum operated, solution feed variety and of these, the direct cylinder mounted chlorinator is the most common. These are made by several firms such as Wallace & Tiernan, Hydro, Regal, Capital Controls, and Fischer & Porter. The troubleshooting directions that we are giving you will apply in general to most of these brands with some variations between different makes. Some systems require more specialized troubleshooting that we will not cover here.

1. **Your chlorinator is not feeding any chlorine.**

   a) Look for the simple things first. Is the cylinder empty? Check the weight. Check the "loss of chlorine" indicator on the chlorinator.

   b) Is the cylinder turned on? If you have a switch-over system, perhaps the cylinder valve was not turned on when it was installed.

   c) Is the ejector pulling a vacuum? These chlorinators will not work unless there is sufficient vacuum. Disconnect the tubing at the ejector (injector) and test the vacuum with your finger. It should be easily apparent. Of course you have to have enough vacuum, but at this point of your checking, just look for a go/no go.

   If there is no vacuum, or only a little, your problem is probably at the ejector. Check the pressure differential across the ejector nozzle. Compare the differential to your manufacturers recommendations. Has the pressure at your booster pump dropped off, or has the back pressure at the point of injection increased? Is there any restriction between the ejector and the diffuser at the point of injection? If there is good pressure differential, but no vacuum, look for a problem in the ejector. You may have trash in the nozzle, or a stuck check valve or an air leak in the ejector body.

   If you do not have good pressure differential, look for problems in your booster pump. Has it lost suction? Air lock? If it is a turbine style, or multistage pump with by-pass control, try closing down the by-pass to bring up the pressure to the nozzle but don't close it off completely. Has the pressure at point of injection increased?

   If there is good vacuum at the ejector, look for air leaks at tubing connections. Tighten tubing nuts by hand as pliers will crack them.

Sometimes it is a good idea to just remake the tubing connections. You can trim the end off the tubing at each connector and remake the connection. It is a good idea to warm the end of the tubing with something, even a match flame will do, when you make up a connection. It will fit easier and better. Use tubing only from a chlorinator manufacturer. Hardware store tubing may have a short life.

Check the vacuum tubing from the ejector for its condition. Is it brittle? Is air leaking at the switch-over? Is air leaking at the top of the metering tube? Did the switch-over fail to operate? Is the filter plugged?

2. **The chlorine meter shows chlorine is feeding, but there is little or no chlorine residual in the water.**

   a) You probably have an air leak upstream of the meter and the meter is measuring air instead of chlorine. If you have a separate metering module, check all tubing connections. Check the gasket at the bottom of the metering tube.

   b) You could have a warped or cracked chlorinator body that is leaking air. If you have a switch-over module, inspect the gasket or O rings that seal it. You could also have a leaking diaphragm, but check everything else before assuming that.

3. **The chlorinator will not feed at the full rate but it is ok at a lower rate.**

   a) You may have an air leak in the vacuum line or connections which is using up your ejector capacity. Check as discussed above for no chlorine feed.

   b) You may be borderline in pressure differential at the ejector. If you have a wall mounted ejector, look for and eliminate any restrictions in the line downstream of the ejector. Increase the size of the line, or better yet, relocate the ejector to the point of injection.

4. **There is a strong chlorine odor inside the chlorine room.**

   a) There probably is a chlorine leak at the connection to the cylinder. Carefully tighten the yoke using the wrench supplied. NO CHEATERS! Look for the leak using ammonia. If tightening the yoke does not stop the leak, shut off the chlorine cylinder valve and wait until the system pulls down to a vacuum. Then remove the chlorinator or vacuum regulator and replace the cylinder gasket using a new lead or composition gasket. Don't try to reuse gaskets. They always leak.

   b) There may be chlorine leakage around the cylinder valve stem. If ammonia shows that this is the source, tighten the cylinder packing gland nut a little at a time. Too much tightening may interfere with the operation of the valve. If you cannot stop the leak, send the cylinder back to your supplier.

5. **There is a strong chlorine odor outside of the chlorine room.**

   a) Your chlorinator is venting because of positive pressure. This is almost always caused by dirt on the seat of the internal shut-off valve.

The only satisfactory solution is to dismantle the chlorinator or vacuum regulator and clean the seat. Your owners manual should give you directions. If it is too complicated or requires special tools, it may be necessary to send the unit back to the factory. All chlorination systems have a filter at the connection to the cylinder. It is important to keep this filter in place! Just a spec of rust or dirt can cause this venting problem or restrict other orifices. Every time a new cylinder is placed in service, check this filter. Replace it if it looks dirty or if it has been used for more than one or two cylinders of gas.

b) Your unit may have a weak or broken diaphragm spring. This may be operator repairable in some models or it may require factory replacement.

One of the biggest headaches for an operator is failure of the ejector check valve to close properly. This may allow water to back up into the system. Repair generally requires a complete disassembly and cleaning of both the ejector and chlorinator components.

These are the more common problems that operators find and most are easily correctable. It is wise to keep a stock of the more common replaceable gaskets, O rings and parts recommended by the manufacturer of your system. Acquaint yourself with maintenance and repair procedures for your particular system.

Here are a few rules to keep in mind when trying to make a chlorinator work. They will cover almost all of your troubleshooting conditions.

1. Chlorinators must have a vacuum to operate and ejectors must have proper pressure differential to produce the vacuum.

2. Air will enter at any point possible and will reduce or replace chlorine.

3. In a cylinder mounted chlorinator, there are only three places where chlorine can escape: the gasket, the packing and the vent.

DONALD G. WILLEMS SCHOLARSHIP AVAILABLE

The Montana Sections of the AWWA/WPCA are offering a $500 scholarship to qualified applicants who are attending a Montana school and whose major is in the water or wastewater field. Interested persons should contact their respective Financial Aid Director for applications. Please enclose transcripts, resumes, and statement of professional goals along with the application and send the information to the address listed below. If no applications are currently available at your school, send us a request for one.

All scholarship applications must be received by February 19, 1989.

Henry Elbrecht, Scholarship Committee
MWPCA/MSAWWA
C/O City of Helena
316 N. Park
Helena, MT 59623

TRAINING MANUALS AVAILABLE

WATER TREATMENT PLANT OPERATION

California State University, Sacramento, has available two EPA operator training manuals titled Water Treatment Plant Operation, Volumes I and II. The material was prepared by persons working in the water treatment field, field tested nationally, and reviewed by the National Environmental Training Association. Emphasis is placed on the knowledge and skills operators need to know to operate and maintain water treatment plants.

Topics covered in **Volume** I of the water treatment program include reservoir management, intake structures, coagulation, flocculation, sedimentation, filtration, disinfection, corrosion control, taste and odor control, plant operation and laboratory procedures. An appendix contains information on how to solve water treatment arithmetic problems, definitions of water words and subject index.

Volume II includes information on iron and manganese control, fluoridation, softening, trihalomethanes, demineralization, handling and disposal of process wastes, maintenance, instrumentation, safety, advanced laboratory procedures, drinking water regulations, administration, and an appendix similar to Volume I.

The manuals may be used as a correspondence or self-paced instructional program, on-the-job training, text books in a classroom, or reference books.

The manuals cost $30.00 each and are available from Ken Kerri, Office of Water Programs, California State University, Sacramento, 6000 J Street, Sacramento, CA 95819-2694, phone (916) 278-6142. Enrollment to the home-study instructional programs cost an additional $30.00 per volume.

OPERATION OF WASTEWATER TREATMENT PLANTS

California State University, Sacramento, offers home-study correspondence courses for the operators of wastewater collection systems and treatment plants. The training manuals were prepared by collection system and treatment plant operators to help other operators develop the knowledge and skills necessary to do their jobs and to pass certification examinations. These programs were developed in cooperation with the California Water Pollution Control Association for the US Environmental Protection Agency.

Operation of Wastewater Treatment Plants, Volumes I & II-

Volume I contains information on the responsibilities of a treatment plant operator, why wastes must be treated, treatment facilities, and also how to operate and maintain racks, screens, comminutors, sedimentation tanks, trickling filters, rotating biological contactors, package activated sludge plants, oxidation ditches, ponds, chlorination facilities and treatment plant arithmetic problems. Topics covered in **Volume** II include activated sludge, sludge digestion, solids handling, effluent disposal, plant safety and good housekeeping, maintenance, laboratory procedures, uses of computers for plant O & M, analysis and presentation of data, and records and report writing.

The costs of the training manuals for Operation of Wastewater Treatment Plants, Volume I and II are $20.00 and $25.00 respectively. The manuals can be purchased by anyone interested in the field. If a person wishes to enroll in the home-study correspondence courses the enrollment fee is an additional $30.00 per volume. Successful completion of each course earns a person 9 CEUs or 6 semester units.

For additional information on these and other similar courses, contact Ken Kerri, Office of Water Programs, California State University, Sacramento, 6000 J Street, Sacramento, CA 95819-2694. Phone (916) 278-6142.

WPCF REGIONAL MEETING - BILLINGS

By: Joe Steiner
Billings Water Treatment Plant

On July 15 and 16, 1988, the Region VII WPCF meeting was held in Billings, MT. The regional meetings are held to allow member association officers the opportunity to be briefed on federation activities and allow association input on future WPCF activities. Beth Turner, President, Robert Perry, Deputy Executive Director, and Shirley Rawlins, Member Association-Liaison Officer represented the Federation. The member associations represented were the British Columbia Water Pollution Control Association, Pacific Northwest Pollution Control Association (Washington, Oregon and Idaho) and Montana Water Pollution Control Association.

After being briefed by Ms. Turner on the new and old services offered by WPCF, Bob Perry explained the goverance structure by which WPCF works. From there discussion took place on how to deal with significant government affairs issues and what information could be shared and learned between member associations.

Our attention was then directed to what the future may bring to the wastewater industry. Will we all run ultra-pure treatment facilities? Will we need PhD's in organic chemistry to understand our discharge permits? Will every valve or pumping change have to be approved by your attorney? Questions to ponder but no solutions were developed. The meeting generated good discussion and left the MT Association officers with some new ideas and thoughts that may be beneficial to our organization.

In attendance from the MT Association were John Connell, Pres.; Tim Hunter, Pres. Elect; Mark Richardson, Trustee; Howard Peavy, Trustee; Darrel Langford, PWOD Representative; Jan Cranor, Past Pres.; Kristi Kline, Committee Chairman; and Joe Steiner, Director.

A SUCCESS STORY

by Doris Roberts
Northern Montana College

Northern Montana College and the Water Quality Bureau cooperate in implementing an EPA grant known as the 104 (g) Program. The program consists of two phases. During the first phase various wastewater facilities are evaluated (Comprehensive Plant Evaluation, or better known as the CPE). The evaluation involves examining four areas: operation, maintenance, design, and administration. After the evaluation phase, plants are selected to participate in a training program (Composite Correction Program). The selection is based on whether or not improved performance can be achieved without major modification and/or construction. During the second phase, the training is directed towards eliminating the factors limiting a specific treatment plant's performance.

The following is a brief summary of the major performance limiting factors determined during the evaluation phase, and the activities during the training phase carried out at the Hinsdale Wastewater Facility. It should be noted that the County officials and the operator coöperated fully in the program. Their support is what made the training efforts a success.

Hinsdale is a small community in north central Montana with a population of approximately 240. The wastewater treatment facility is a 30,000 gpd package-type extended aeration, activated sludge plant.

During the evaluation, the following major performance limiting factors were identified.

- Wastewater Treatment Understanding: Performance was limited by the operator's lack of understanding of biological wastewater treatment concepts.

- Process Control Testing: Process control equipment was not available or inadequate.

- Sludge Wasting Capability: Sludge wasted could not be observed or sampled during the wasting process. No waste sludge flow measurement capability existed, and the airlift pump used for wasting plugged. The sludge storage tank had limited capacity.

- Performance Monitoring: Effluent sampling did not appear to be representative of actual plant effluent quality.

- Equipment Malfunction

- Process Controllability: Return sludge could not be controlled as needed. No means of flow measurement was available.

- Clarifier: The clarifier had relatively shallow depth.

- Lack of Preventive Maintenance Program

As a result of the evaluation, a composite correction program (CCP) was initiated. The following activities were carried out during the CCP.

Testing equipment was purchased.
Weekly process control summaries were initiated.
Operator received intensive training.
An operator maintenance check list was developed for routine activities.
Diffuser valves were repaired.
Land was located for the application of digested sludge.
Minor modifications were made to the plant.
- Air lift piping to allow wasting from both sides of the clarifier and waste sludge flow measurement.
- Decant piping to allow decanting from the sludge holding tank, and observation of decant quality.
- Drain taps for waste sludge sampling.
- Bar screen
- Clarifier covers were put in place for winter operation.
- Skimmer basket
- Solenoid valve and timer to control the rate of returns.

Operator received increased wages due to the increase in work load.

A 14 month period was required for the needed modifications to be established and then implemented.

The CCP at Hinsdale was successful in providing the training necessary to achieve improved Effluent quality. Effluent BOD_5 and TSS are shown in Figure 1. A sludge accountability performed for the period prior to the CCP, and based on sludge wasting requirements during this CCP, assuming population based loadings, projected effluent BOD_5 and TSS values of 73 mg/l and 120 mg/l respectively (the figures used to depict effluent quality prior to the CCP).

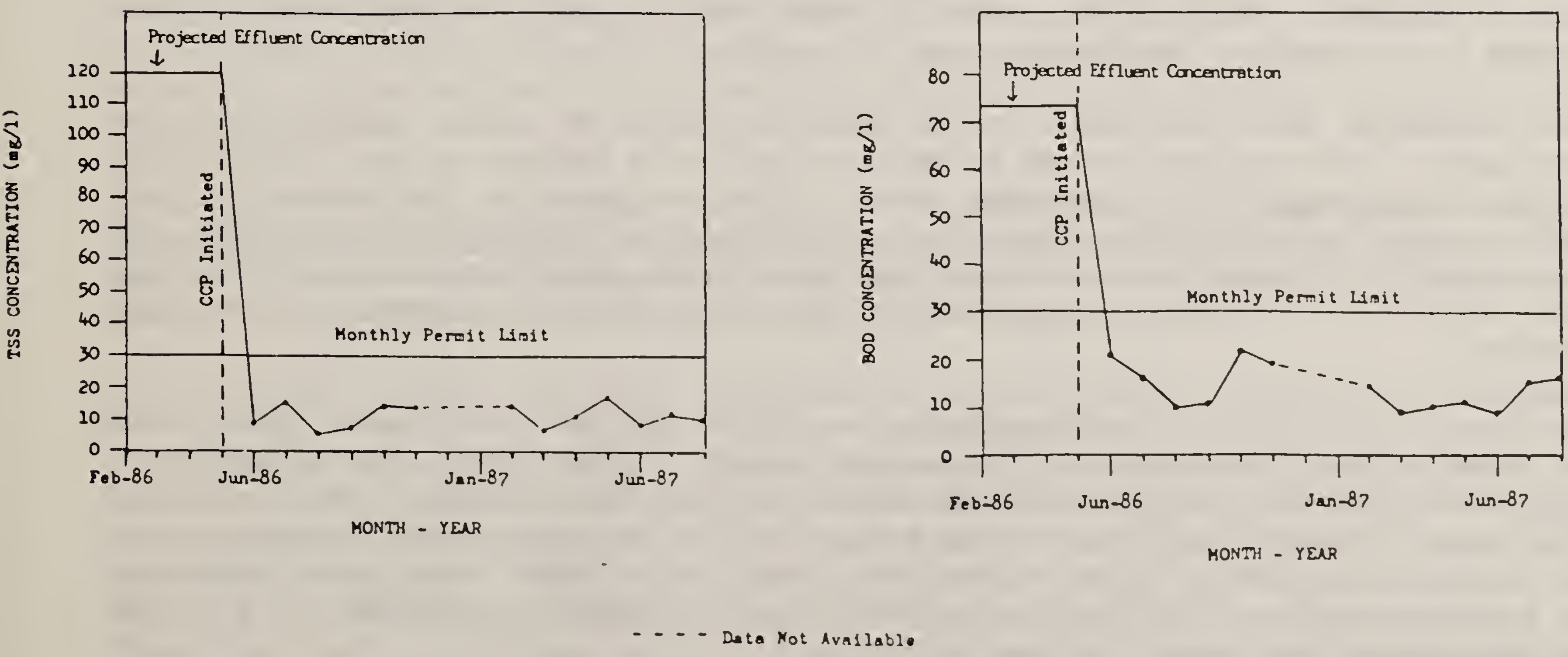


Figure 1. Hinsdale Wastewater Treatment Plant Effluent Quality

RADIO TELEMETRY IN CONRAD

By: Steve Ruhd
Water Treatment Plant Operator, Conrad

The water supply for the city of Conrad comes from Lake Francis and the water is treated with a direct filtration plant. The city has a pump station on Lake Francis which is located 10.5 miles northwest of the water treatment plant. The pumps are controlled and monitored from the water plant. The elevation difference is about 70 feet and there is one small hill between the pump station and the plant.

When the plant began operating in 1979, the pumps were controlled by a BIF telemetry system using Mountain Bell phone lines. This system took six months to get operational and it was a big headache after that. It seemed that the area contractors always wanted to rewire the phone system with their backhoes. Mice and rain caused even more problems with the lines.

The system was designed with a transmitter at the water treatment plant which started the pumps at the pump station. There was also a transmitter at the pump station which sent back status reports to the plant about whether a pump was running or if there was a power failure. There was also a remote water plant start up. We used most of the spare channels in the system for adding features to make the system more reliable and easier to operate.

When we started looking for a radio system we felt we wanted to keep the system simple, it had to be expandable, service on the radios had to be available in the area, and the company we worked with had to be reputable and have good references. The system also had to have a pay back in less than five years. With the leased line costing $240 per month we had about $14,400 to work with.

We started looking for radio control equipment in 1984. We weren't in any hurry so we looked until we found a system that would do the job we wanted it to do. In the beginning we told the suppliers we wanted to send eight contact closures each direction. They didn't seem to know what we were talking about! Most wanted to see our wiring diagrams and we complied.

The proposals that came back ranged from rewiring to just a price with some brochures. One supplier seemed to want to sell us a system and kept calling but he wanted to rewire the electrical panels. The rest gave us the impression that they thought we should buy their system just because they said it was O.K. No one seemed to realize that we needed to understand the system because we had to live with it. We were not satisfied with the initial proposals so we kept looking.

In the spring of 1987, the Motorola sales representative in our area came by and we asked him if he sold a system that would do the job. He called in a representative that worked with Motorolas' Intrac 2000 system. When asked if the Intrac system could send eight contact closures each direction with radios he said "no problem". This made us skeptical but a short time later they gave us a demonstration. We bought the system after carefully considering all that we had learned in researching radio controls.

They did a field survey and determined that 5 watt radios with directional antennas would do the job despite the hill. They supplied the radios, encoders, decoders, 4-control outputs and antennas. We installed the antennas, mounted the panels and did the interfacing. The area service rep hooked up the antennas to the radios and checked the system out.

The system was installed in mid February but we didn't do the interfacing then. Instead we put a switch in at the water plant to fire a relay at the pump station that closed a set of contacts to send a signal back to the plant to light a pilot light. This was so we could test the system before hand. We played with it and it worked without missing a lick. On February 29th we did the interfacing and have not had a problem with it yet.

The system we purchased can be expanded to handle any digital or analog transmissions we may need in the future. The radios also came with a battery to operate during a power failure. The pay back for the entire system installed, including our labor, is less than 3 1/2 years.

We are very happy with the system and feel that all the time we spent researching radio control systems really paid off. We feel that our success was due to the fact that we knew the system we wanted to replace, we knew what we wanted the new system to do, we knew what we didn't want it to do and we spent a lot of time researching the options available.

We have several other changes to make to our water plant to make it more efficient and more reliable. We will try to approach them with the same cautious attitude we used in purchasing our radio telemetry system.

STUDENT RECEIVES RECOGNITION

By: Martha Dow
Northern Montana College

Debra Rice, a student in the Associate Degree Water Quality Technology Program at Northern Montana College, won first place in the Operations Category of the 1988 Water Pollution Control Federation Student Paper Competition. Pamela Anderson, also a student in the Water Quality Technology Program, was runner up in the contest.

Debra will present her paper entitled "The Effects of Oil and Grease on the Filamentous Populations in a Complete Mixed Activated Sludge Plant" in a poster session at the WPCF conference in Dallas, Texas in October. She has also received a $1,000.00 award and a certificate of excellence.

The original research and paper were done as an assignment for the Environmental Microbiology course and as part of the on-the-job training in process control. The study was conducted over a one-year period at the Havre Wastewater Plant to determine if filamentous bulking correlated with seasonal temperature variation and periodic fluctuations in the oil and grease discharged from an industrial pretreatment plant. The study will be expanded in the future to compare the seasonal and industrial impact on the characteristics of the activated sludge at this plant with other wastewater plants that have different nutrient effluent qualities.

Congratulations to both Debra and Pamela!!

SLIME AND THE ART OF WATER SYSTEM MAINTENANCE

By: Kate J. Miller
Water Quality Bureau, Billings Regional Office

Water is an essential element of life. But because of the physical, chemical, and biological contaminants that it may contain, it can be a hazard to health.

The incidence of waterborne disease is on the increase. Documented outbreaks of waterborne disease generally involve the breakdown of standard procedures which has resulted in the gross contamination of the water source. The increase in problems may also be due to the growing obsolescence and increased demand on water treatment and distribution systems.

Effective treatment and monitoring along with proper operation and maintenance of the water system are all factors integral to the protection of public health from waterborne diseases caused by pathogenic (disease-causing) microorganisms. This article will discuss some of the sources of water system contamination, types of bacteria, some of the factors affecting biofilm growth in water distribution systems, and treatment and remedial measures.

WHERE DOES THE CONTAMINATION COME FROM?

A. Sources outside the treatment and distribution system

Some common sources of bacterial contamination from the environment outside the treatment works and distribution pipes are:

1. Drilling Equipment (for those systems using groundwater) - Iron bacteria and other microorganisms can be carried from one site to the next by improperly disinfected well drilling equipment.

2. System Maintenance - Whenever piping, well casings, reservoirs, or any part of the normally closed system is opened up and exposed to the environment, the possibility for contamination exists. Disinfection should be performed after any line repairs, extensions, or equipment installations.

3. Cross-Connections - Existing cross-connections can be responsible for contamination when a condition of back-siphonage or back-pressure exists in the distribution system.

4. Aquifer Contamination - Under the right circumstances, those systems using groundwater can be contaminated by improperly designed and installed septic drainfields, wastewater lagoons, waste dumps, etc.

5. Physical Sanitary Defects - Improperly sealed well casings, storage reservoirs, or distribution pipes can permit the entrance of debris or organic matter which will support the growth and reproduction of bacteria.

B. Mechanisms inside the treatment and distribution system

In his Project Summary titled "Bacterial Growth in Potable Water Distribution Systems", W.G. Characklis described two mechanisms by which microorganisms appear in a distribution system. These are:

1. Breakthrough - Breakthrough is the increase in bacterial numbers resulting from viable (able to grow and reproduce) bacteria passing through the disinfection process.

2. Growth - Growth is the increase in bacterial numbers resulting from bacterial growth in the distribution system downstream of the disinfection process. In this process, nutrients from the water are used by the bacteria.

In a conventional water treatment scheme of coagulation, flocculation, and filtration, there is evidence which indicates that bacteria are likely to adsorb to the filter media and the continuous flow of water provides the influx of nutrients for growth and reproduction. As the cells reproduce, a fraction of the cells detach and re-enter the fluid stream. If these cells survive the disinfection process, then breakthrough has occurred.

Chlorination of the backwash water has been found to reduce bacterial growth in the filter which thereby affects the microbial processes in the distribution system. Characklis found that microbial activity in the filter is advantageous because the microbial nutrients are removed in the plant and are not available for subsequent growth in the distribution system. However, the adsorbed microorganisms cause higher filter head loss. Nonetheless, the effluent from a biologically active filter results in less biological activity in the distribution system. (1)

TYPES OF BACTERIA

A. Heterotrophic Bacteria

The United States Environmental Protection Agency has proposed the use of the Standard or Heterotrophic Plate Count (SPC or HPC) analysis to determine the bacterial quality of a drinking water supply. The HPC is related to the degree to which bacteria multiply in the distribution system and also indicates the presence of bacterial nutrients that may be precursors to trihalomethane formation. The HPC is not intended to replace the coliform test but rather will be used as "a sensitive tool to signal an increased potential risk of breakthrough of undetected pathogens." (2)

Heterotrophic bacteria pose a health risk as their presence may inhibit coliform recovery, and some heterotrophic bacteria may be opportunistic pathogens. A high HPC indicates a general deterioration of the treatment and disinfection process. The presence of a large population (greater than 500 organisms/100 ml) of heterotrophic bacteria would indicate that the chlorine residual in the distribution system is insufficient or nonexistent.

B. Coliforms

The mechanisms by which coliforms may survive in chlorinated distribution systems are:

1. encapsulation (slime formation),
2. association with pipe tubercle material (product of iron pipe deterioration),
3. cell clumping,
4. adhesion to pipe surfaces, and,
5 attachment to suspended particulate matter.

Many coliform occurrences in distribution networks are due to the _Klebsiella_ genus of bacteria. _Klebsiella_ species may originate either from feces or from the environment. Approximately 30-40% of warm blooded animals, including humans, have _Klebsiella_ in their intestinal tract. Often coliform densities range from 1 to 125 organisms/100 ml and their occurrence is often widespread in the distribution network.(3)

The presence of _Klebsiella_ species is unsatisfactory because they signal that environmental conditions are conducive to bacterial growth. _Klebsiella pneumoniae_ is a common total coliform and often confirms out to be a fecal coliform. It is an opportunistic pathogen causing enteritis, upper respiratory tract infections, septicemia, meningitis, peritonitis and urinary tract infections.

Although _Klebsiella_ can be controlled effectively by adequate disinfection, these organisms can be protected by particulate material, pipe sediments, biological debris, and slime coatings that they may develop around their individual cells. These slime coatings protect the cells from chlorine and the bacteria adjust their metabolism to survive on the minimal nutrients supplied in the pipe sediments. Once the organisms become established, periodic sloughing of cells into the flowing water can result in positive coliform tests.(3) This sloughing can continue until hydraulic shearing limits the colony growth or elevated levels of chlorine penetrate the slime and inactivate the bacteria.

Ineffective control of turbidity, inadequate disinfection, or poor operational and maintenance procedures will provide opportunities for the passage through treatment barriers and the colonization of coliforms. Passage of any coliforms into the plant effluent indicates that barriers are ineffective and there is an increased chance for waterborne pathogens to follow the same pathway.

HOW CAN BACTERIA LIVE IN A WATER PIPE?

We know that bacteria have a great tolerance to physical and chemical stress, high rates of metabolic activity, and have the capacity to utilize unusual organic and inorganic compounds as carbon and energy sources. Two of the most important factors that affect bacterial growth in distribution systems are disinfection (chlorination) and the physical integrity of the distribution network.

Other factors that are associated with bacterial changes in the distribution network are the chemical and biological quality of the finished water, water temperature, and the residence time of water in the distribution network.

A. Biofilms

The term "biofilm" refers to microbial cells that have been immobilized at the pipe surface or on a particle. The cells are often immobilized in a matrix of "slime" which will protect cells from the oxidative effects of chlorine. This slime layer also adsorbs anions, particulates, and other cells.

B. Resistance to Disinfection

The major factors affecting the efficiency of free chlorine as a disinfectant are pH, turbidity, water temperature, contact time, and free residual chlorine concentration. Although many organisms are not necessarily chlorine resistant, conditions in the distribution system may be such that bacteria are able to survive in the presence of an appreciable chlorine concentration.

Reilly and Kippin found that the free chlorine residual has more affect on organisms associated with the Heterotrophic Plate Count (HPC) than on coliform organisms. It was also found that coliforms can reproduce within a distribution system with only a trace amount of organics present. It appears that coliforms (especially encapsulated coliforms) can withstand a free chlorine residual of 0.2 mg/l. Klebsiella pneumoniae and other Enterobacter species have been detected in water containing a free chlorine residual of 3.0 to 4.0 mg/l. (4)

While water produced in a treatment plant may be of high bacterial quality, finished water may be subject to conditions in the distribution system which may have adverse effects on bacterial numbers. At any rate, disinfection is not a substitute for conventional treatment processes in the production of potable surface water.

C. Physical integrity of the distribution network

Analysis of several systems in the U.S. has shown that encrustation, or tubercles, resulting from the deterioration of water mains, support concentrations of bacteria and that microorganisms are present in high concentrations at the outer edge of the encrustation where it is in contact with finished water. (5) The tubercle material not only shields the bacteria from the effects of chlorine, but it also exerts a chlorine demand and so lowers the free chlorine residuals.

Some species of bacteria have been implicated in the deterioration of pipes which increases the frictional resistance to water flow, and thereby increases pumping costs. Bacteria may contribute to corrosion by activities that alter the Redox potential and pH by oxidation of ferrous iron or by the production of metabolites that act as complexing or solvent agents. Water quality changes which affect corrosion and sediment deposition appear to be related to the ability of microorganisms to colonize within encrustations on the interior surfaces of pipes. The formation of these encrustations is further affected by flow rates, chlorine residuals, nutrient availability and pH.

In studies conducted by W.G. Characklis significant numbers of viable cells (up to 1,000,000,000,000 bacterial cells per gram sediment material) were found in pipe deposits. 0.5 to 3.5% organic carbon was also found in these deposits.

HOW CAN YOU GET RID OF THE BACTERIA?

The degree of bacteriological quality changes can be attenuated by producing water with lower turbidity and nutrient levels and by minimizing sediment deposits through corrosion control. Corrosion can be reduced by an effective control program which may include protective coatings such as carbonate deposits, cathodic protection to prevent electrolysis, water treatment to remove corrosive chemicals, and the use of corrosion resistant pipes and other materials.

In severe cases, regular flushing or elimination of dead ends may be the only long term solutions to continual contamination from bacterial populations protected by and multiplying within deposits that have developed for years.

Here is a list of possible control measures:

1) If you have conventional treatment, pre chlorinate to 1.0 mg/l.

2) Maximize your turbidity and bacterial removal through coagulation.

3) Raise the system pH through lime addition. Some studies have suggested that an elevated pH is more effective for biofilm control than chlorination. If you are softening this will also enhance precipitate formation and improve turbidity and hardness removal. One must note that at high pH there may be a trade off between the disinfective properties of a high pH and the reduced disinfective capacity of chlorine at a high pH.

4) Flush all of your mains. This will get rid of the sediment and move free chlorine into the far reaches of the distribution system.

5) Use the laboratory to track the success of each operation by sampling strategic points between the supply point and the far reaches of the distribution network.

6) Disinfectant residual should be adequate (usually between 0.2 and 0.5 mg/l). Shock chlorination of biofilms that have not previously been chlorinated produces dramatic sloughing of bacterial cells into the fluid stream.

7) Well disinfection - If it has been determined that the well is the source of bacterial contamination, the entire system must be disinfected since contaminated well water has been pumped throughout the distribution system. Wells are most commonly disinfected by the use of household bleach or calcium hypochlorite. It is best to pour a large volume of disinfecting solution down the well in order to

displace the water column in the well. It is also possible to use the well pump to circulate chlorinated well water back down the well by connecting a clean garden hose to a hose bib on the discharge side of the pump, running the hose down the well casing and opening the valve on the hose bib.

SUMMARY

Once disinfection and flushing has successfully eliminated most of the colonies, the coliform outbreaks would be expected to become sporadic because the coliform organisms would be limited primarily to the colonies protected by sediments, slimes, or organic deposits in the sheltered parts of the system. (6)

If adequate disinfection is practiced, no coliforms should be found in a properly maintained pipe network, including reservoirs and stand pipes. To consistently achieve this goal, careful control of all water treatment operations is required, plus adequate disinfection of all new line extensions and pipe repairs and periodic cleaning of storage reservoirs. With an effective cross-connection control program and thorough flushing of the distribution system, the chlorine demand should be low, coliform colonization improbable and the required chlorine concentration minimal.

ACKNOWLEDGEMENTS

I gratefully acknowledge the assistance of Dr. W.G. Characklis, Director of the Institute for Biological and Chemical Process Analysis, Montana State University, Bozeman, Montana.

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PROBLEMS OF A TRICKLE SYSTEM

By: Tom Wing, P.E.
Resource Engineers, Helena

A small water system near Helena was designed to accommodate a low capacity well drilled for the central water supply. The design incorporated a "trickle" method of filling cisterns at each home. This means that the demand on the well was controlled by providing flow regulators at each cistern and the cisterns then provided the volume of water needed to meet normal and peak demands of the home. The well operates on a timer to fill the cisterns during low water usage periods.

The system originally operated as planned, but as more homes were connected, some cisterns were installed without flow controllers and some were left out altogether. As the development filled up, the operator had an increasingly difficult time ensuring all homes had water when needed. The lack of flow restrictors caused excessive demand on the well and this situation was compounded by several leaks in the water mains that were difficult to locate because of the porous nature of the rock in this area.

Since some of the homes were connected directly to the water main without a storage cistern, these homes were drawing from the main as if it were a storage tank and created zero, or possibly negative, pressure in the upper ends of the main. Also, since there was no clear responsibility for maintenance of the cisterns, some were not adequately protected from outside contamination and probably not properly disinfected when work was performed on them.

The result of the operating conditions showed up as shortages of water at many homes, increased pumping costs and quite numerous failing bacteriological test results. An inspection of the system revealed significant problems with cistern construction and maintenance, water line leaks and improper connections to the water main. A plan for remedial action was therefore developed in order to make operation more reliable and to assure that the supply is safe at all times.

The remedial action plan included inspecting each service and bringing it up to standard with a proper cistern, identifying and repairing leaks, adding a second well, and installation of a moderately sized reservoir at the highest point in the system to ensure positive pressure and reduce pump cycle rates. The system controls were changed to operate the well pumps from the level controllers in the reservoir and the timer mode of operation was removed. Gas chlorination was added at the well control house and individual cisterns provide the required contact time.

In summary, the system has been substantially renovated and appears to work much better. Time will tell if all the problems have been solved.

The lessons learned from this system point out the need to carefully consider construction control along with management and operational concerns when designing a water system. This particular situation did not provide for construction inspection, central control of the water system or management of the cisterns. The operator could not enforce installation of cisterns or their proper maintenance. This situation is not completely resolved since the by-laws of the homeowner's association have not been changed, but all involved parties now understand the importance of proper care of the cisterns.

A "trickle" system can work but it needs just a little more thought in initial planning than a more conventional system. As operators, try to bend the ear of your engineer about potential operation and management problems and encourage him to incorporate necessary features in the design.

Billings Worker Buried Alive

By: Roger Clawson
Billings Gazette - Tuesday, July 19

A 30-year old Billings man was killed Monday when a trench dug for a sewer line collapsed, burying him alive.

Randall Lee Kuch, 3204 Cook Ave., was part of a crew working for his father, Eddie H. Kuch, installing a sewer service line at 4431 Loma Vista when he climbed down into the completed trench to inspect it. "He just walked down to the head of the trench to see if everything was ok, when bang! it caved in," a friend of the family who had rushed to the scene said.

John Pavich, a plumber working on a similar job a few blocks away, was on the edge of the narrow 8-foot-deep trench, talking to Kuch, when the sandy sides gave way and buried the man. "I was working on a job not far from here when I noticed Kuch's outfit in the neighborhood," Pavich said. "I had some digging that needed done and came over to see if I could hire their backhoe."

When Kuch disappeared under yards of sand, co-workers plunged into the trench and began frantically digging. Pavich, who has been buried twice himself in similar cave-ins, ran to a nearby house and knocked on the door. "I banged on five doors in the neighborhood before I found someone home," he said. Brian Harvey, 12, at 4443 Loma Vista, dialed 911, handed the phone to Pavich and stood by to give directions to the neighborhood.

Billings Fire Department received the call at 1:05 p.m. and a fire truck arrived at 1:12 p.m. along with an Aero-Medical Ambulance and Deaconess Medical Center's advance life support team. The Deaconess team, in radio contact with doctors at the hospital, assumed medical control of the rescue operation. While firemen and paramedics dug to reach the victim, Kuch's mother, Virginia paced a nearby driveway, crying. Kuch's father tried to comfort his wife, then drove away with her when the rescue effort changed tempo and became a body-recovery operation.

Fire Chief Bobbie Williams said, "Doctors at the hospital decided after the man had been buried for nearly 35 minutes that nothing medically could be done for him." Pavich, eyewitness to the accident, was shaken afterward. "I've got a couple more jobs to do, then I might get out of this business," he said.

TROUBLE-SHOOTING PUMP PANELS

By: Don Sweeney
Sweeney Brothers Tractor Company - Fargo, North Dakota

Taken from the Jan-Mar 1988 Official Bulletin of the North Dakota Water and Pollution Control Conference; reprinted with permission from the North Dakota Department of Health

When there is a problem with a pump panel or control, start out by checking the basics:

A. Is the power turned on (i.e., main switches, control switch)?
B. Check the indicator lights, if any (i.e., "pump called," "pump run," seal minders, power monitor, alarm).
C. Turn the Hand-Off-Auto (HOA) switch to the "hand" position. Does the pump run?
D. Push and release the reset button. Does the pump run?

The above checks complete a basic trouble-shoot of the panel. If you do not intend to investigate any further into the panel, make note of the status of the indicators before you call for help.

If you or your local electrician decide to further trouble-shoot, use a voltmeter to check the power (EXERCISE CAUTION: high voltage three-phase is very powerful):

A. Check each power phase to the other two, and each phase to ground.
B. Check for phase reversal if the cabinet contains a power monitor.
C. Check for lightning damage.
D. Check the power at the top of each motor starter.
E. Check the control circuit power switch, fuse and transformer, if there is one.
F. If the motor starter closes and the pump does not run, check the power at the bottom lugs of the starter where the power leads go to the pump motor.

After checking the power circuits and finding them to be properly energized, move on to the control circuits. Get the manufacturer's schematic drawings out of the cabinet. (NOTE: Most control circuits utilize 120V AC power. Other voltages are sometimes used, but the basic control schematics are quite similar).

A. Check the power monitor, if your cabinet has one, to ensure the control power is getting to the control circuit.
B. Looking at the schematic, follow the lines to the various terminals and tie points. (NOTE: The schematic diagram does not represent how the cabinet is physically wired. The schematic does, however, show how power flows from point to point to accomplish overall control of the pumps).
C. Using the schematic, see that control power flows to the "hand" position of the HOA switches, the terminal blocks for the "stop" and

"alarm" floats, and other optional equipment mounted in the panel. With your voltmeter, check to see if power is getting to these various points within the panel.

D. Turn the pump control switches to the "hand" position. The schematic now tells us the power will flow to the motor starter coil.

E. The arrows on the schematic indicate the action points where voltage drop occurs and a definite action place (i.e., motor starter closes, indicator lights illuminate, relays energize, etc.) Check how the power flows through the coil, through the motor starter overload switches, and on to the neutral.

F. The motor starter should not be closed allowing the pump to run. If it is not, check the voltage at the overload side of the coil:
   1. If it is high (120 Volts), one or more of the overload switches is open - RESET.
   2. If it is low (about 0 Volts), the coil is open or burned out-REPLACE.

When the pumps work fine in the "hand" position, but not "automatic", go back to the schematic and follow the power flow through the level control floats:

A. Check the float switches in the wet well to ensure they are not tangled or wedged and are operating at the designated levels (i.e., at the proper height and anchored.)

B. The schematic drawing shows us the power flow through the float switches, the sequencer (alternator), and on to the "auto" terminal of the pump switch. With your voltmeter, check to see if power is getting to the "stop" float feed terminal, through this control float, and back to the return terminal block.

C. Check for power flow from the "stop" float feed terminal to the "lead" and "lag" float feed terminals. Check power flow also to the motor starter's "hold" auxiliary switches and to the sequence coil.

D. Following the schematic, next check power flow through the "lead" and "lag" floats by observing the voltage at the float return terminals. If you are not receiving power flow through the floats to the return terminals, yet power flow is getting to the feed terminals, check the floats for proper attitude.

E. If the floats seem to be at the proper attitude, turn the control power off and check for broken wires leading to them. If no breaks can be found, place a jumper wire across the terminals of the suspect float and momentarily turn the control power back on. If the pump starts and runs, turn the power back off and replace the float. If the pump does not start, leave the power on and continue checking.

F. When power flow is getting to the return terminals, next check the flow through the sequence relay contacts and on to the "auto" terminal of the pump HOA switch. Again, if power is getting to a control device but not through it, the device becomes suspect and can be jumpered for test or simply replaced.

G. The same test procedures apply to the pump HOA switch. Although broken wires within the panel can cause failure, this condition is rare. Turn the power off and check and tighten the screws at the wire termination points. This may find and solve your problem.

H. The "alarm" float and "alarm" relay are checked out the same as above.

This completes a basic check of your pump panel. Other level control devices may be used in your panel, but carefully following the schematic diagram and checking the power flow at the various points along the way will usually expose

CASPER COLLEGE IN CASPER, WYOMING OFFERS TRAINING COURSES

Casper College's Water Quality Technology Department will be offering several water distribution system classes this fall in Casper, Wyoming.

On November 15, 1988, they will be presenting a Control Valves Workshop at Casper College. This course will cover operation, installation, maintenance and trouble shooting of various control valves. The following valves will be covered: pressure relief, pressure sustaining, air release, altitude control and check valves. The course will be worth .7 CEU's and has a registration fee of $50.00.

The second program will be offered on November 17-18 and will cover Large Backflow Preventers. This program will also be at Casper College. This course will cover installation, testing and repair of large (2 inches and over) backflow preventers. All major valve manufacturers have been asked to participate in the program. Hands on will be stressed and you should have the opportunity to see all the various configurations currently on the market. Repair techniques will be stressed during this program. This course will be worth 1.4 CEU and has a registration fee of $100.00.

For further registration information on either workshop please call 307-268-2212 and ask for the Continuing Education Program.

NOMINATIONS NEEDED

Operator's Meritorious Service Award

Attention all AWWA members! The Montana Section Awards Committee is asking for nominations for the 5th Annual Operator's Meritorious Service Award. The award is to recognize special performance by operators in one or several areas including but not limited to compliance with public health standards, plant maintenance, development of new ideas, training, or outstanding achievement beyond normal operating responsibilities. Past recipients of the award are Hugh Wilkins of Great Falls in 1985, Leonard Willett of Helena in 1986, Bob Kruse of Red Lodge in 1987, and Mike Patterson of Butte in 1988.

Any member of AWWA can submit a nomination for this award. Please remember that your nominee must be an operator and a member of AWWA. If you would like to receive award criteria and an entry form, please contact:

Terry Richmond
Chairman, Awards Committee
P. O. Box 1057
Kalispell, MT 59901
Phone # 752-2216

The nomination deadline is January 3, 1989. The award will be presented at the annual AWWA/WPCF Conference in March 1989 in Great Falls.

IS FEDERAL FUNDING THE ANSWER TO WATER SUPPLY NEEDS?

By: Robert L. Rebori
President of Smith and Lovelace, Inc. - Lenexa, Kansas
Chairman of the Water and Wastewater Equipment Manufacturers Association

Taken from the March 1988 issue of Water Engineering & Management, reprinted with permission from the editor

The water utility industry is facing a new era of challenge in providing the general public greater protection of their drinking water sources. Congress mandated, and the EPA is in the process of administering, the Safe Drinking Water Act Amendments of 1986. These amendments set forth strict directives for issuing primary drinking water standards and establish new initiatives for protecting underground sources of water.

Throughout this legislative reauthorization process, a number of organizations cautioned Congress as to the exorbitant costs which would be incurred to comply with these new requirements, especially for smaller community systems. Their concerns did not go unheeded.

Currently effort is underway in Congress to draft legislation for the purpose of "...establishing a Public Water Supply Assistance Program to provide for improvement, renewal, rehabilitation, repair, and modernization of the nation's water supply systems." The Water Supply Assistance Act (United States Senate Committee on Environment and Public Works, September 25, 1987) states its specific purposes as follows:

* Establish a trust fund from which capitalization grants will be made to states for the purpose of establishing revolving funds for use by the states to finance the construction of water system improvements.

* Establish a program of research and development for innovative technologies in the construction, operation, and maintenance of water systems.

The effective timing of this program would be for the fiscal years ending September 30, 1991, through September 30, 2000.

The proposed amount to be appropriated is $500 million for each of the fiscal years. Of this, $25 million is to be appropriated for construction of water supply improvements with innovative technologies, and an additional $20 million is to be appropriated for each of the fiscal years for research and development for innovative technologies.

The Water Supply Assistance Act as it currently is proposed dictates that 45 percent of the funds are to be spent for systems servicing 3,300 individuals or less, and 45 percent for systems servicing over 3,300 individuals, with the balance of 10 percent to be applied at the discretion of the governor of the state.

One must understand that the proposed Act differs from the familiar Construction Grants Program and the State Revolving Fund (SRF) aspects of the current Clean Water Act, which is wastewater legislation. First is the matter of the federal funds. Under the proposed Water Supply Assistance Act, these are to be distributed from a "trust fund" at the federal level to a State Revolving Fund. The Construction Grants Program was a partial funding of specific projects, or under the

State Revolving Fund, seed money representing 80 percent of a state's SRF, with the state contributing 20 percent.

The concept of the trust fund at the federal level is not new. We have the highway trust fund as an example, and its source of funds is a tax on gasoline and fuel paid by the consumer. The proposed sources of funds for the Water Supply Assistance Act are:

* A 3 percent tax on "plumbing supplies" which would be defined to include, "All pipings, fittings, fixtures, equipment and components used in distributing and transporting of water for domestic, commercial, sanitary, and industrial purposes, as well as public purposes, including fire protection and recreation."

* A national uniform water fee of 4 to 8 mills per thousand gallons of water.

* General Treasury revenues.

The major difference is that under the highway fund program, while the users pay for the fund through the fuels tax, the funds are distributed as a grant to the states, and the individual really only pays once. Under the system proposed for the Municipal Water Supply Trust Fund, the money will be raised through user's fees. However, these users must pay several times over, as the funds will be distributed to the municipality via a State Revolving Loan Fund. The users must pay the monies back over a 20-year period so as to create a "fund in perpetuity." Thus, users will be paying for the funds via a tax, higher prices for goods and services utilizing water, and for the use of the water itself. Also, depending on the method of funding, the individual will face higher costs as a result of the tax on the use of equipment, materials, etc., for sanitary disposal. One must be cautious here and recognize that the highway trust fund distributes less than it received for capitalization and interest, and, in a sense, is used by the Congress and Treasury as a hedge on the federal budget.

Another main difference between the Construction Grants Program of the Clean Water Act and the proposed Water Supply Assistance Act is that the Clean Water Act's Construction Grants Program is administered by the EPA. The current proposed legislation for the Water Supply Assistance Act calls for the program to be administered by the Corps of Engineers and creates a whole new federal bureaucracy to support this role. Unfortunately, we do not have the space here to deal with the pros and cons of this decision except to consider it as a part of the innovative and research and development aspect of the proposed Act.

As indicated above, the proposed legislation requires that, of the $500 million authorized to be distributed from the Municipal Water Supply Trust Fund, $25 million per year is to be spent for innovative technological projects. The term "spent" may be misleading. The current proposed legislation seems to imply (by the absence of a grant program) that the funds will be lent to the municipality, rather than as under the Clean Water Act's Construction Grants Program (as it implies) a grant of funds for which the federal portion would not have to be paid back by the municipality as part of a loan program. On the wastewater side, there was a true incentive for the municipality and the consulting engineer to consider innovative technology. The current proposed Water Supply Assistance Act has, in a sense, removed or diminished the value of an incentive for the consulting engineer and the municipality to risk the investigation or installation of the innovative technology, as the cost for such is not a grant but a loan which must be paid back. This could be a drawback to the program.

Also, the risk for installation of alternative technology into the drinking water treatment and/or distribution network without extensive test results could be disastrous. The failure to remove a contaminant if the water is consumed could have far more troublesome problems for the consulting engineer and the municipality than that which was at risk in installation of innovative technology for a municipal sewage treatment system. This risk can be summed up as a potential litigation risk that is not worth taking, as the rewards under the proposed Water Supply Assistance Act are negated by the loan concept.

If there was a failure of innovative technology in a sewage treatment plant, there would not be the perceived or real risk to the health effects of the community as there would be if a failure occurred in a drinking water treatment or distribution system. Sewage can be hauled away, impounded, or partially treated. Drinking water can only be deemed safe or unsafe. While this last statement might be simplified, it is how the consumer or litigious society sees the failure.

The other question is, does the 45 percent set aside for small water supply systems for 3,300 individuals or less apply to the available $25 million set aside for innovative technology? If so, then this means that $11,250,000, is also available for water supply systems with populations of 3,300 or more. Thus, even if the concept of a loan versus a grant for innovative technology could be overcome, the restrictions on the funds, the broad mandate as to what would be eligible for funds, dilutes the whole concept and will not encourage the introduction of innovative technology for water facilities.

If innovative technology is to have a chance, it should be restricted to the cost of engineering, design, supply of equipment, and construction of innovative technology to treat water and should not be used for programs which should be under the auspices of the Clean Water Act (point and nonpoint source pollution), Land Management & Soil Conservation, Agriculture (tilling and pesticide usages), and dams, impoundments, or other water projects currently under the jurisdiction of the Corps of Engineers.

We must also consider the impact of costs for a program utilizing federal monies. Our experience under the Construction Grants Program indicates that the cost of a treatment plant built by using federal funds, complying with federal laws and regulations (Ford-Bacon-Davis, etc.) costs approximately 20 to 30 percent more than a similar plant built utilizing private or local funds. The concept of the federal "trust fund" and the tax specific proposals to capitalize the fund will further increase the cost to the municipalities. One must remember that the proposed 3 percent tax is a tax on both water and wastewater, not just on water. Also, this tax impinges on maintenance and operation costs, increasing their costs, and perhaps causing deferral of important maintenance, especially in those areas where the population served is less than 3,300 individuals.

The proposed Water Supply Assistance Act also requires $20 million per year to be set aside for research and development. Again, it is not specific as to how the funds are to be spent. Should it be divided 45/45/10, the same as the loan funds between water systems for 3,300 individuals more or less, or should the active fund be spent under the direction of the Corps of Engineers? The description is much too broad and needs further defining. One must question the practicality of having the Corps of Engineers controlling research and development for water when it is the responsibility of the EPA under the Clean Water Act and Safe Drinking Water Act to set the health standards as well as enforce them. It would seem that research and development aimed at technological advancements should be grouped under the control of one agency rather than be dissipated among several and be diluted by repetitive administrative costs.

Currently, the technology exists to treat water to whatever standard is set. The problem is cost and to what level the treatment must be accomplished. Manufacturers have been capable of removing contaminants to measurable levels for a number of years. However, as we increase our ability to measure and correspondingly decrease the allowable levels of contaminants, we cause several problems to evolve.

While the industry has had the technology to remove measurable contaminants and has actually been doing so for certain industrial customers (e.g. plants using process water, electric power utilities, and microchip manufacturers) the transfer of this technology to the public water utility market can be a complex and costly undertaking. One must recognize that the equipment itself can be costly and is often complicated and expensive to operate. Without discussing the operating and maintenance cost effects on the ability of the individuals or utilities to pay on an on-going basis, there is the problem of the capital cost of the plant. Research and development could aid in designing improved, cost-effective methods, but it takes approximately three years of research and development to bring technology to the marketplace. This is a reasonable time frame if one is shooting at a fixed target. However, since the levels of contaminants allowed are changing almost yearly and new levels determined, the research and development programs can be almost ineffective. Couple this with the fact that the proposed Act wishes to establish the research and development effort under the control of the Corps of Engineers, while the responsibility for the enforcement and establishment of the health effects will be in the hands of another agency; namely the EPA.

Will the research and development funds be used to develop new, cost-effective treatment technologies, or will they be used to fund water source feasibility studies such as dams, reservoirs, etc.? If the control remains in the hands of the Corps of Engineers, as a manufacturer we would prefer that the research and development funds be used to fund water source feasibility studies, and the true research and development remain in the hands of the private sector. However, we must recognize that we cannot obsolete our technology by edict before such technology can generate a return to both the manufacturer and the user. We must continue to do health effect studies so that we can establish reasonable cost-effective removal levels.

In summary, it seems evident that while the concept of providing monetary assistance to individual water supply districts is commendable and perhaps needed, the method as suggested by the proposed Water Supply Assistance Act does not solve the problem. It creates a new federal bureaucracy which is not needed. It creates a very oppressive national tax. It increases the cost of water supply and wastewater treatment via the tax and federal regulations, which must be included in the costs of design and construction. It would be far more efficient to have a program more closely related to the 1987 Clean Water Act's State Revolving Loan Funds administered through the EPA but under the control of the state governments. It is the responsibility of the EPA to set the standards and enforce the regulations. It does not make sense to have a separate agency responsible for the administration of funds to help conform to the standards set by the agency. The approach as suggested by the proposed Water Supply Assistance Act is much too costly and is an expansion of the federal government.

The concept of set-asides for research and development is also commendable. However, it would be much more effective if this set-aside was placed in the hands of the private sector and the EPA. This assumes that the research and development is for technological advances in treatment. If the concept is for development of water supplies, then perhaps the research and development monies could be shared by the Corps of Engineers for surface water projects and the U.S. Geological Service for groundwater. At any rate, it would make economic sense to channel these funds through an existing agency, again the one that sets the level of treatment, namely the EPA.

The last point is the set-asides for innovative technology. The possibility of any set-aside being in a loan program and the higher potential liability for failure in drinking water does not give me encouragement that this program will be well used.

As current chairman of the Water and Wastewater Equipment Manufacturers Association (WWEMA), I have instructed our organization to conduct a thorough evaluation of this proposal and develop a consensus position which provides long-term solutions to the needs of our nation's water supply systems. I urge all participants in the drinking water industry to carefully consider the implications of this program before seeking any "quick fix" remedies which may inhibit - instead of promote future progress.

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WHAT IS A COMPUTER FOR?

By: Jack L. Williams
City of Helena

It's Monday, an ordinary Monday, and then a man comes in and says, "I have your new computer, and are you going to love it!" You are unimpressed. The man sets up the computer (if you're lucky), hands you a stack of books two feet thick, and says this new computer will save you all kinds of time and make your life easier. You never see him again.

It is now Friday, you have read all the books about DOS (Disk Operating System), RAM (Random Access Memory), ROM (Read Only Memory), directories, files, filenames, etc., etc., etc. The only thing you have really learned is where the A: drive is, but don't know why it needs a colon or why it is not called drive 1. You have looked all over for drive B: but can't find it. You suspect they have hidden it just to frustrate you or that they just didn't give it to you but billed you for it anyway. You are still trying to figure out how to take the floppy out of the C: drive.

Your supervisor walks in and asks what you have learned. After giving an hour dissertation, you suspect he is bored. He lifts one eye lid and says "Is that all?" You silently sink into your chair and say yes. He then looks at you with his one all-knowing eye, (you are sure his eye is glass) and says "So now what do you do with it?"

So what is a computer good for? It allows for the input, storage, manipulation, and output of information. Its' uses fall into four major categories: word processing, spread sheets, data bases and "other". The "other" category includes many different and varied operations. It includes everything from small commands such as setting the printer to the complete operation of a manufacturing plant (water and sewer plants are manufacturing plants).

Word Processing

The first category I will discuss is the word processor. This seems to be the main use of most personal computers and maybe why the bosses' secretary gets a computer before you do. There are many good word processing programs on the market, some of the top ones appear to be WordPerfect, WordStar, and Display Write. If you are the one who gets to choose the program I suggest trying them out and talking to others about their choices. Once you learn any of these programs you will not want to change, no matter what the others offer. So try to pick one that you are comfortable with and has all the features you need. You will not get a second choice.

You may ask, "Why do I need a word processor?" I have a typewriter and I can tipe preddy goood. After you find out it can check the spelling of every word in your document you might want to reconsider. And when the boss comes storming into your office and says your report needs to be rewritten because the third paragraph on page eight has to be deleted and you have spelled the name of Mayor Smith (Smyth) wrong on every page, and oh, he needs it by ten this morning, (and you'd like to remain employed), you will wonder how you ever lived without a computer before. Later you will discover that you can type up one letter, tell the computer the name of a list to merge with and the computer will type up hundreds of form letters all by itself. This is the same principle used by the advertisers who send those letters addressed to Mr. 1234 street; try not to copy this procedure.

After you have selected the word processor you need and want with all the bells and whistles you could ever use, you will find out it will not do something you need it to do. However the newest upgrade coming out next month and only costing big bucks will do it. And the other program that you passed up costing half the price already does this and more. It would be wise not to mention this to the boss! Plan on spending some time learning this program. What, they never mentioned that when they sold you the computer. I wonder why??

Don't take this wrong, a word processor and a computer are a marriage made in heaven. It will cause you some frustration to learn how to use it but after a short time it will become indispensable. Your old typewriter will sit in the corner and never be used except to address an occasional envelope. If nothing else, use the computer as a word processor; you'll be glad you did.

Spread Sheet

You're sitting at your desk, it's Thursday and most of the work is completed. You ease comfortably into your chair feeling the broken spring poking up through the tear in the seat cover. It's three in the afternoon, the sun is shining and you wish you were off. The boss comes in eyeing the cup of coffee on your desk, the first this afternoon. He hands you a stack of old power bills and says "I need you to forecast our utility costs for the next year using a one, one and a half, two, two and a half, and three percent increase in cost. I need this information graphed for each of these rates and I need it by tomorrow's staff meeting." He casually walks out of the office, taking the afternoon off to go golfing. Time to quit and find another job? Maybe.

You figure you will be at the calculator the rest of the day and well into prime-time TV when you remember the new computer. You hope all those night classes will pay off. Within the hour you have set up columns with the months, utility costs by month, and costs by percent increase. Another hour and you have produced five beautiful graphs with headings. The next morning you hand these masterfully-produced graphs to your boss. He takes them and walks off, a mumbled thanks seems to come from somewhere.

With a spread sheet you can create large, self-referencing mathematical projections that calculate almost instantly. You can change one or more pieces of information and see within seconds what the answer is. And if you enter a wrong figure, just change it and have the spread sheet calculate all the new answers in seconds.

A spread sheet can be invaluable in doing complex or repetitive calculations. It can do cost analysis and forecasting. In fact, its only limit is your imagination. Look for one that will fit your needs. Check around to see what others are using and how they like them. Two that you might want to check are SuperCalc and Lotus 123.

Data Bases

What is a data base? One of the simplest data bases is a card file. This could be a phone index or mailing list. This program will allow you to create data bases. You can then use the program to extract any part or parts of data from the data base. You can sort on multiple fields, print out only selected fields, set up reports on the information stored, or do arithmetic computations with the information. You can even use several different data bases and interconnect them, (inventory, sales, shipping, orders, etc.). In fact almost anything you could do by going through each record by hand and extracting, doing calculations on, sorting, and listing, can be done by a data base in a much shorter time. There are many different programs on the market, among them DBase III Plus, RBase, and FoxBase. I suggest you take your time in selecting one of these programs. In fact, should you choose to purchase this program, do so only after you are familiar with the computer and the other programs you have purchased. I strongly suggest taking a class on how to operate this program.

Meanwhile the boss is coming in with that "I gotcha" look in his one good eye. He wants you to list all of the customers who owe more than one hundred dollars and are behind more than sixty days, but only the ones that live on streets that begin with the letters A-M. No problem. After all, you are beginning to anticipate these little requests and have already set up the data base and installed the records. All that is left is to set up a filter and print out the records.

Diverse Secondary Functions (other)

What's left? Lots. The diversity of the programming industry is astounding. You can get computer assisted design (CAD) programs, programs to do inventory, bookkeeping, billing, and checking. There are programs to schedule maintenance or write and compile your own programs. You can even get a computer to run your entire plant. In fact if you have a need there is probably a program already written for it.

I think I will suggest that we project our future costs on the spread sheet and make graphs of these costs, write up a form letter in our word processing program, output a mailing list from our data base program for the form letter, and combine the whole thing to justify our rate increase. And who knows, maybe the reason the boss is checking up on me so often is because he is worried about his job.

Summary

Information is the key to the future. He who can control, use, and access information the best will stay ahead in this world. To be able to do this and control the abundance of information we receive today, you need a computer. It will speed up your access to information and it will help you to put this information out in a superior and orderly fashion. It will make your reports professional, reflecting directly on your work and that of your business.

The days when you could put out a sloppy report that was "good enough" are gone. You will have to produce the best every time you get at a keyboard. If you do not keep up with the newest technology you will fall behind. If you want to keep your job in the future you will have to strive to improve yourself everyday. The computer can be one of the best tools to do that if you are willing to learn and grow. So what is a computer for?? ..... Whatever you want!

REPORT TO MONTANA AWWA MEMBERS

By: Denise Ingman, Chairman

I'd personally like to thank the 1988 Host City Committee for coordinating and directing an excellent conference. Thanks also to all the other committee members who worked so hard. Jim Melstad, chairman of the Registration Committee, reported attendance to be 167. AWWA and WPCF will each net about $2650 from the conference. Lyle Meeks, this year's chairman of the Host City Committee has reserved the Heritage Inn, Great Falls, for **MARCH 29, 30, 31** for the 1989 conference.

Within this issue of the Clearwater you'll find lists of all the committees, both AWWA and joint committees of AWWA/WPCF. If your name isn't on a list you thought you had signed up for or you just never got the chance to sign up, don't fret, there's STILL TIME. It's just a simple matter of letting me know and I will, in turn, let the committee chairman know of your interest.

Some of the committees have been busy already. Joint Education has co-sponsored 12 seminars in 1988. Government Affairs had a meeting in April in Great Falls with Craig Vogt, the Deputy Director of the Criteria and Standards Division, EPA, regarding our concerns with the Amendments to the Safe Drinking Water Act. (Water Quality and Rural Water were also involved.) Since this meeting, several letters have been sent to Senator Max Baucus, a member of the Environmental Affairs Committee, reiterating our concerns. Lyle Meeks and Jim Melstad are also trying to set up a meeting to discuss the issues one-on-one with Senator Baucus. The Awards Committee is asking for nominations for the 1989 Operator's Meritorious Service Award; please nominate a deserving candidate! The Safety & Heroism Committee would like you to participate in the section survey on loss-time injuries. This is a chance for your utility/town to be justly recognized for safety awareness but you'll have to fill out the paperwork to be included.

National Drinking Water Week was May 2-8. The proclamation was signed so late by President Reagan that there was essentially no lead time to get any activities planned for that week. The Montana Section of AWWA, did, however, present an award of recognition to Alleen Whitney, a Capital High School student from Helena for her research in an area of interest to the drinking water industry. (See article elsewhere in this issue.)

Lastly, on behalf of the entire Montana AWWA Section, I'd like to thank Cindy Fuhrmann, Secretary-Treasurer, for an excellent job during the past 1 1/2 years. Cindy has had to resign her post to take a new job with the City of Fort Collins, Colorado. Her major role there will be in process control at the newly renovated municipal water treatment plant. Thanks, Cindy, and good luck!

PASSING EXAMINATIONS FOR FULL CERTIFICATION OR OPERATOR-IN-TRAINING (OT) 3-12-88

CLASS 1:

James Austin, Laurel, 1C-ot,*
Marjorie Beckman, Fort Peck, 1B-ot;1C-ot
James Burnham, Billings, 1A
Charles Buus, Whitehall, 1B-ot
James Cain, Havre, 1C-ot
David Caracciolo, Havre, 1C-ot
James Cass, Havre, 1B-ot
William DeMeyer, Billings, 1B & 1C
Ronald Elery, East Glacier, 1B-ot
Scott Emerick, Billings, 1A
Thomas Fletcher, Livingston, 1C-ot
Mark Foster, Havre, 1C-ot
Donald Hancock, Livingston, 1C-ot
Lyle Hedglin, Bozeman, 1A
Robert Hicks, Missoula, 1A
Jerry Jansma, Billings, 1A
Larry Kelly, Billings, 1C
Allen Kelm, Miles City, 1C-ot*
Kenneth Kessner, Great Falls, 1A
Svend Larsen, Helena, 1B-ot*
Curtis Myran, Miles City, 1C-ot*
Drue Newfield, Havre, 1C*
Thomas O'Donnell, Billings, 1B
Joseph Paulin, Homedale, Idaho, 1C-ot
Robert Piorek, Missoula, 1C-ot
Peter Pleticha, Nampa, Idaho, 1C-ot
Thomas Radcliffe, Bozeman, 1C-ot
Brian Riser, Colstrip, 1A-ot;1B-ot
Ronald Rorabaugh, Boise, Idaho, 1C-ot
Richard Shelley, Havre, 1C-ot
William Thomas, Havre, 1C-ot
Danny Trettin, Helena, 1A
Rory Schmidt, Havre, 1C-ot

CLASS 2:

Michael Hagel, Forsyth, 2A*
Robert Jacobsen, Forsyth, 2A*
Truman Kaldor, Neihart, 2B-ot
John Knudson, Libby, 2A
Kevin Martin, Spirit Lake, Idaho, 2C-ot
Raymond Miller, Belgrade, 2A3B
Timothy Miller, Havre, 2A*
William Moller, Columbia Falls, 2A
Timothy Peterson, Chinook, 2C-ot
John Richardson, East Glacier, 2A3B-ot
Hugh Robertson, Kalispell, 2B & 2C
Daniel Turner, Columbia Falls, 2B
David Wyrick, Forsyth, 2A-ot

CLASS 3:

Terry Druyvestein, Missoula, 3A4B-ot, 3C-ot
Michael Leichtnam, Hot Springs, 3A4B
Elston Loken, Ekalaka, 3C
Julie Marthaller, Anaconda, 3C-ot
Norman Vellinda, Great Falls, 3C
Will Redman, Laurel, 3C
Orval Silbaugh, Alberton, 3C
Charles Worley, Wolf Point, 3C*

CLASS 4:

Mike Baker, Kalispell, 4AB*
Douglas Baty, Dixon, 4AB & 4C
Dale Dvorshak, Dodson, 4AB-ot & 4C-ot
Joe Frazier, Lewistown, 4AB
Daniel Grieve, Great Falls, 4AB
Russell Giulio, Basin, 4AB
Larry Hass, Glendive, 4AB
William Herrington, Townsend, 4C*
Fred Holland, Simms, 4C-ot
James Houck, Belt, 4C*
Dean Krob, Huntley, 4AB
Jack Miller, Judith Gap, 4AB
William Nelson, Great Falls, 4AB
Thomas O'Donnell, Billings, 4A
Charles Buus, Whitehall, 4A
Steve Rice, Glendive, 4AB
Randel Rieckmann, Whitefish, 4AB
Greg Saks, Bozeman, 4AB
Orval Silbaugh, Alberton, 4AB
William Wise, Drummond, 4C
Harry Wolfe, Shelby, 4AB
Michael Zuppo, Belgrade, 4C

CLASS 5:

Jack Flanagan, Great Falls
Kim Haaland, Inverness
Linda Harris, Whitefish
Robert Hollar, Ulm*
Ray Knight, St. Regis
John Lee, Bozeman
Stanley Petersen, Polson
Tim Wall, Glendive
Robert Wathen
Ira Woods, Kalispell

COAGULANT PACKAGING: LOOK OUT FOR PREVIOUSLY USED BARRELS!

Earlier this Spring, an operator at a surface water treatment plant noticed the barrels holding their polymer had labels indicating other compounds had been stored in the drums. Further investigation showed some of the drums previously contained sulfuric acid and some contained a water conditioning descaler. Neither of these products were approved for potable use, and it was not known whether the drums were adequately cleaned before the polymer was transferred to them.

This re-drumming practice could have resulted in the introduction of contaminants to the public water supply. Since current drinking water regulations require monitoring for several chemicals at the parts per billion (ppb) level, operators must be aware that re-used barrels are a potential source of contamination.

If you receive a potable water product in what you suspect is a previously used drum, contact the Water Quality Bureau at 444-2406. You may also want to contact the supplier directly to determine whether they take appropriate action to prevent contamination of the product you purchased. Precautions should include the use of designated drums and hoses, National Sanitation Foundation (NSF) approved detergents for potable water and appropriate rinsing procedures, along with the isolation of the drumming process to protect against contamination with other chemicals.

If the suppliers' procedure does not sound adequate, don't take the risk! Although it may be cheaper to use recycled containers, you may pay for it later through water system contamination. Cross-contamination by this route is easily avoided with single-use drums.

WATER CONSERVATION RESOURCES ARE AVAILABLE !!

The Montana State University Extension Service has a lot of water conservation information and materials available to the public. Some of their materials include a four page listing of water conservation tips for the home, yard and garden; flow restrictors for faucets and showers packaged with instructions and other water saving tips for the home; materials geared toward students; and livestock and range drought guides.

For information and assistance please contact:

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